SCIENCE

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VOLUME XVII

JANUARY—JUNE 1891

NEW YORK
N. D. C. HODGES
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Dr. Hann's Studies on Cyclones and Anticyclones.

PROFESSOR FERREL'S letter in *Science* of Dec. 19, commenting on mine of May 30, closes with the suggestion that I should make further statement of the matter of Dr. Hann's studies, which I do with pleasure.

The best reasoned general account of the convectional theory of cyclones and anticyclones (by the latter term I mean areas of high pressure) that I know of is given in Professor Ferrel's "Popular Treatise on the Winds." Of various statements in regard to cyclones, the following may be quoted from the concluding paragraph on their vertical circulation: "The greater temperature of the interior [of cyclones] causes an upward expansion of the air and greater vertical distances between the isobaric surfaces here than in the exterior part where the temperature is less" (p. 241). In regard to anticyclones or areas of high pressure, of the kind that Dr. Hann has investigated, the following explanation may be quoted: "The principal cause of the large areas of very high barometer which frequently occur in the higher latitudes in winter is undoubtedly found in the clearness of the atmosphere over these areas and the intense coldness produced by the radiation of heat at a time when little is received from solar radiation. The density and pressure of the air are much increased from this cause, and the areas are too large and irregular for this disturbance to give rise to a cyclone with a cold centre" (p. 345). The inversion of temperature accompanying such areas of high pressure is referred to on the next page, but still with the implication that the mass of air in the anticyclone is cooled below the temperature of the surrounding atmosphere, and therefore that it descends and flows out at the base by gravitative convection.

These quotations might be further extended, but they suffice to show that the essential of the generally accepted theory of the areas of low and of high pressure which appear so frequently on our weather-maps is that the first are relatively warm, and the second are relatively cold, when compared with their surroundings. Cyclonic and anticyclonic areas are both of common occurrence, and therefore as a rule their temperatures should be respectively above and below the normal temperatures of their time and place.

Records of temperature made on high mountain-peaks furnish the best means of testing the convectional theory of cyclones; for, even if all other tests were successfully borne, failure under this test would be fatal to the theory. Dr. Hann's essay on the anticyclone of November and the cyclone of October, 1889, as observed in the Alps, furnishes the best means of applying this test that has come to my knowledge. It is true that one example of each of these phenomena is not sufficient for final determinations, and it is very apparent that the results would be far more convincing if they included records from mountain stations scattered over a much larger area than that of the Alps. Surely no one will be more careful to supplement these deficiencies, whenever possible, than Dr. Hann himself.

I do not see any reason for believing that the anticyclone that stood over the Alps in November, 1889, was exceptional in its nature or in its relation to the surrounding atmosphere. All of its features except its mean temperature warrant the belief that it was a typical example of the phenomena referred to under the heading of "Areas of High Pressure" in Professor Ferrel's treatise. Unless it can be shown to have been of exceptional nature, the abnormally high temperature of its air mass is a direct contradiction of the fundamental idea of the convectional theory of areas of high pressure. It has not been claimed that the conditions of a cyclone exist in this high-pressure area; but the explanation of high-pressure areas as quoted above is a direct corollary of the cyclonic theory. If the corollary is contradicted by facts, the theory needs revision. The burden of proof in this case lies with those who would maintain that the anticyclone in question was of so exceptional a nature that it cannot be regarded as a representative of its class. Its long duration does not show it to be a thing of another kind from other areas of high pressure: the long duration merely gave good opportunity for repeated observation of its prevailingly high temperature.

As to the cyclone of October that was examined by Dr. Hann, it was certainly of moderate development; but it was as good an example, according to Dr. Hann, as he could find. The observations that he quotes show that its general central temperatures were below the normal of its time and place. The fact that the temperatures were not determined in the free air, but at stations on the surface of the ground, does not seem to me to invalidate their use here; for on the peaks where the critical observations were made the air is generally in motion, and the mass of the mountain is small; and for both these reasons the control of the temperature of the air by the ground is not great enough to explain the reported low temperatures. Over a broad surface of a lowland, where the wind is weaker and the opportunity for contact of air and ground is greater, the case is different. The low temperature of the central part of this cyclone may fairly be regarded as contradictory to the convectional theory of cyclones, unless it can be shown that the example in question was surrounded by air more abnormally cooled than its own, or unless it is shown to have been an expiring cyclone,—one whose long circulation had so thoroughly exhausted its supply of warm, moist air, and so successfully warmed the surrounding air, that it had no further support, as Professor Ferrel has shown might sometimes be the case. It is true that Europe might offer more examples of self-exhausted cyclones than occur in this country, for they are there advancing from moister into dryer regions; but it is difficult to believe that so considerable a deficiency of temperature as probably occurred in the case under consideration should be produced before the cyclonic motions had stopped, if they depended entirely on a convectional origin. It is not likely that so exceptional a case as this must be, if it is to be explained by convection, would have been the very case that Dr. Hann happened to choose for his studies. It is still more unlikely that both the cyclone and the anticyclone here referred to should have been exceptional members of their classes, both departing from the normal in a way that would contradict the convectional theory. As these are the first examples of their kind to be carefully examined by means of regular observations at stations at so high a level, the probability is strongly in favor of their being ordinary, and not extraordinary, phenomena; and as such they did not possess the peculiar temperatures that the convectional theory would lead us to expect. Although mere probability of this kind does not close a case, it seems to me that it may be fairly said to open it.

I do not see that there is any necessary contradiction in this discussion. The theories under consideration are not mutually exclusive. Both may be true. The liberation of latent heat from condensed vapor is an aid to the circulation in both cases. Certainly there is nothing in Dr. Hann's essay to make one think that thunder-storms, tornadoes, and desert whirls are not convectional phenomena. It is entirely possible that true convectional cyclones might prevail in the tropics, while driven cyclones might characterize the temperate zones. A cyclone begun chiefly by one process might be continued chiefly by the other. Of course, this is hypothetical: it was not my intention last May to regard it in any other light. For that reason my letter closed with an "if." Others besides Professor Ferrel, however, understood me to have abandoned the older theory and taken up with the newer. I tried to state Dr. Hann's point of view, and I do not regret having stated it so fairly that it was taken for my own. That I had not adopted it as fully as Professor Ferrel implies, may be inferred from the close of my eighth paragraph and from the middle of the ninth, as well as from the ending of the letter already referred to. But in making this explanation, I do not wish to be understood as not welcoming the new theory. The abnormal warmth of anticyclones had been in my mind as a difficulty in the way of convection, yet I had expected that cyclones would be found to be still warmer; and it was not until reading Dr. Hann's forcible statement that I perceived I had become too strongly settled in favor of the prevailing theory. On recognizing this partiality, I made all the more effort to give full and fair consideration to the new one. It seemed to me nothing less than a duty to announce the facts and Dr. Hann's interpretation of them in the same journal that had published my outline render-

ing of the other theory some years before; and, in spite of Professor Ferrel's letter, it still seems to me that I was right in saying that the convectional theory needs revision in the light of Dr. Hann's results, but by revision I do not mean abandonment.

The incompleteness of the new theory is not a reason for being silent about it. It should be welcomed, if only for the reason that it will cause a healthful revision of previous views. The value of multiple working hypotheses has been so well set before our scientific readers, that nothing more need be said on that point. I will not venture to speak for Professor Ferrel, but I am sure that practically every meteorologist in the country will profit from a serious re-examination of his knowledge of the theory of cyclones in the light of Dr. Hann's researches.

As to the process by which the general circulation of the atmosphere shall produce cyclones and anticyclones, it is not to my mind necessary that this should be worked out completely before the suggestion of it may be profitably made. But it does not seem impossible that the general winds might here and there crowd together, owing to irregularity of flow; that, where crowded together, anticyclones would appear; and that, between the anticyclones, cyclonic whirls might be formed. It would be indeed a satisfaction if I could here answer all the pertinent questions, and give all necessary explanations, about such a problem; but, if we may judge by the treatment that dynamical meteorology has received thus far in this country, there is only one American who can do that. I wish that he might consider the possibilities of some such process arising from the general circulation of the atmosphere as is outlined above, and, after working them out rigorously, state them as clearly as he has explained the general circulation of the atmosphere itself. Whatever truth there is in the convectional theory of cyclones would not be harmed by such an investigation, while whatever truth there may be in the hypothesis of driven cyclones would pretty surely be discovered by it.

There is a corollary to the suggestion made by Dr. Hann, that may be of interest to those who seek for an explanation of our past glacial climates. It is generally recognized, that, if there were an increase in the activity of our winter cyclones, there would be an increase of snowfall as well; and, if this were carried far enough, the accumulation of snow might last over the summer. The increase of cyclonic activity would presumably accompany an increase in the general circulation of the atmosphere, if cyclones in our latitudes are driven by the general winds; and this would appear in that hemisphere whose equatorial and polar contrasts of temperature were strengthened. Such strengthened contrasts might be expected in the hemisphere having its winter in aphelion, and particularly at times of maximum orbital eccentricity. I do not mean to imply that a glacial period might depend on this condition alone; yet it may be one of many whose varying combinations at times produce a glacial climate, as Croll and J. Geikie and many others have shown; but this particular element of the combination does not appear to have been recognized.

W. M. DAVIS.

Harvard College, Cambridge, Mass., Dec. 27.

Moisture in Storms.

NEXT to the action of heat in storms, the part that moisture takes in them has been greatly emphasized. The so-called "condensation theory" of storms has had wider acceptance than any other. We may imagine a limited portion of the earth's surface heated up by the sun, and this more or less of a circular shape. There will be induced a tendency to an uprising current of heated air, which will continue so long as the central portion is warmer than the air surrounding it at the same level. This tendency, however, would be quickly brought to rest were it not for the fact that the uprising column has its moisture condensed, which liberates latent heat and causes the column to rise still faster. Here is a most remarkable fact, notwithstanding that the release of this moisture diminishes the total amount in the air, and the latent heat warms up the air, both of which causes would stop precipitation at once; yet we are taught that the force of the storm is increased by this process. There is another serious objection among many. If rain occurred at the centre of the storm, this theory might be plausible; but since the bulk of the rain in this country occurs three hundred miles to the eastward of the centre, and over only about one-fiftieth part of the area covered by the storm, it requires an enormous stretch of the imagination to grasp the causation of our wide-extended storms through this condensation effect. We may add still another consideration. It is fairly well ascertained that the upper limit of our storms, as shown by pressure and temperature observations at Pike's Peak (14,184 feet), is far above four or five miles, and may extend to the limits of the atmosphere. Now, the bulk of our precipitation is formed within 6,000 feet of the earth's surface: hence it is plain that the condensation of moisture plays a very subordinate part in our wide-extended storms, and has nothing to do with their generation or maintenance.

I do not propose to discuss at this time all the objections to this "condensation theory," which have been repeatedly advanced both in this and other journals, and which have not been answered, but I wish to present a recent most extraordinary abandonment of this theory by Dr. Hann, who stands at the head of the old school on the continent. I quote from a translation, by Professor Blanford of London, of a recent statement by Dr. Hann. Speaking against the condensation theory, he says (*Nature*, Nov. 6, 1890), "These views are such as I have always enunciated (for a long time, indeed, without any apparent result) in opposition to the then prevalent theories of the local origin of barometric minima through the agency of condensing water-vapor (as contended by Mohn, Reye, Loomis, and Blanford). They now begin to make way and prevail. Most clearly is this seen in the case of Loomis, who, in the course of his own persistent study of the behavior of barometric minima and maxima, has been compelled by degrees to give up the 'condensation theory' to which he formerly adhered so strongly, and to ascribe the origin as well as the progressive movement of cyclones to the general circulation of the atmosphere."

The importance of this utterance from such an authority cannot be exaggerated. While I have shown that Dr. Hann has been misled by his study of mountain observations, yet it seems to me this avowal on his part reaches out far beyond that. As I have just shown, the very life and existence of the old theory depend upon condensation of moisture. Now, if Dr. Hann, who must understand this fact most thoroughly, has deliberately set it aside, must we not conclude that it has an inherent weakness in itself to his mind. Those who are familiar with Loomis's work will be surprised to learn that he ever abandoned the condensation theory of storms.

It would seem that this controversy over the condensation theory is rapidly culminating, and the indications point to a speedy downfall of that theory. It is a remarkable fact that all the objections urged against this theory, now these many years, have been studiously ignored; but a few words from a recognized authority, even though based upon a wrong interpretation of facts, seem to make headway very rapidly. Surely Hann, Davis, and Blanford form a most formidable front against this theory, and it is high time its defenders should come to its assistance ere it be too late.

H. A. HAZEN.

Washington, Dec. 13.

["Letters to the Editor" continued on p. 8.]

NOTES AND NEWS.

AT a meeting of the Royal Botanic Society on Dec. 13, as we learn from *Nature* of Dec. 18, the secretary answered various questions as to the destructive action of fogs on plants. He said it was most felt by those tropical plants in the society's houses of which the natural habitat was one exposed to sunshine. Plants growing in forests or under tree shade did not so directly feel the want of light; but then, again, a London or town fog not only shaded the plants, but contained smoke, sulphur, and other deleterious agents, which were perhaps as deadly to vegetable vitality as absence of light. Soft, tender-leaved plants, and aquatics, such as the *Victoria regia*, suffered more from fogs than any class of plants he knew.

valuable when used against the fluted and other scale-insects. The results have been quite encouraging, and the experiments have already shown that in the use of these washes we have a valuable addition to the underground remedies. Soaps were made by the use of bicarbonate of soda, sal soda, and caustic soda, each mixed with resin. In the earlier experiments the earth was removed about the base of the vine to a depth of six inches and for a diameter of four feet. Ten gallons of the mixture were poured into each hole, and found to penetrate from twelve to sixteen inches or from eighteen to twenty-two inches from the original surface of the ground. Most of the insects, as also the eggs, were destroyed to a depth of sixteen inches. In the later experiments the holes were made only about two feet in diameter; and nearly if not quite the same results were obtained with half the amount, or five gallons of the mixture. The plan which I have previously adopted for the application of insecticides to underground insects, of washing the mixture in with pure water, was tried with good success. Soon after the first application, five gallons of water were added, and five gallons more the following day. This would indicate that in the spring, when rains are frequent (occurring almost every day) in the Sonoma valley, only a small amount of the mixture need be applied, and the rains will do the rest, as examination has shown that up to a certain point each application of water intensifies and extends the action of the original insecticide. The best soap was made with bicarbonate of soda; but the results of that made with caustic soda are so little inferior, while the price is so much less, that the caustic soda and resin soap mixture is the one which I would recommend. The formula which was found preferable is as follows: caustic soda (77 per cent), five pounds; resin, forty pounds; water to make fifty gallons.

The soda should be dissolved over a fire in four gallons of water, then the resin should be added and dissolved. After this, the required water can be added slowly, while boiling, to make the fifty gallons of the compound. To this water may be added at the rate of nine gallons for one, making five hundred gallons of the dilute compound, sufficient for one hundred large vines, at a cost of only eighty-four cents, or less than a cent a vine.

Considering the effective way in which the ravaged vineyards of France have been and are being redeemed by the use of resistant American stocks, and considering the efficacy of some of the direct remedies discovered, it is passing strange that no disposition has ever been made of the premium of 300,000 francs offered in the early history of the trouble by the French Government. It cannot be awarded to any one person, but should be distributed among those whose labors and discoveries resulted in the several feasible and satisfactory methods of coping with the insect.

Introduction of Parasites and Predaceous Species.

The success which has attended the introduction from Australia of *Vedalia cardinalis* has been phenomenal. Indeed, few who have not kept in knowledge of the reports and the actual condition of things can appreciate the remarkable character of the results, not only because of the brief period required therefor, but because of the thoroughness of the work of the little ladybird, and the moral and financial benefit too range-growers which has followed in its wake.

The striking success of the experiment has served to fix attention not only of entomologists, but of fruit-growers and farmers, to this mode of dealing with injurious insects; and there is no question but that the cases in which the experiment may be more or less successfully repeated are numerous. Let us hope, therefore, that the moral effect will be as great as its practical effect in opening up means and ways in the future, as it should serve to remove the disposition to deride any expenditure having such results for its object. Many fears have been expressed, lest, after sweeping off the *Icerya*, the *Vedalia*, being so far as we now know confined to that species for food, should perish, and that the *Icerya*, preserved in some restricted places undiscovered by its enemy, would again multiply and become destructive. I firmly believe what I wrote in my last annual report as United States entomologist: viz., —

"We may hardly hope, however, that the last chapter in the story is written. On the contrary, it is more than probable, and in fact we strongly anticipate, that the *Icerya* will partially recuperate; that the *Vedalia* will, after its first victorious spread, gradually decrease for lack of food; and that the remnants of the fluted scale will in the interim multiply and spread again. This contest between the plant-feeder and its deadliest enemy will go on with alternate fluctuations in the supremacy of either, varying from year to year according to locality or conditions; but there is no reason to doubt that the *Vedalia* will continue substantially victorious, and that the power for serious harm, such as the *Icerya* has done in the past, has been forever destroyed. We have learned, also, that it will always be easy to secure new colonizations of the *Vedalia* where such may prove necessary, or even new importations should these become desirable."

During the year I have endeavored to return the favors received from Australia and New Zealand by sending there some of the natural enemies of the codling-moth; and from last accounts, though jeopardized by the action of the custom-house authorities, the experiment promised success so far as a species of *Raphidia* from California is concerned. I have also endeavored to introduce some of the parasites which attack the Hessian-fly in Europe, and which do not yet occur in this country. These efforts have been made by correspondence; for you will be surprised to learn that the restrictive clause in the appropriations to the Department of Agriculture for entomological work, which limits travelling expenses to the United States, is still maintained in the face of the *Vedalia* experience, where, by the expenditure of fifteen hundred dollars, many millions were saved. The maintenance of this restricting clause in the last appropriation bill, under these circumstances, is a travesty on legislative wisdom, and all the more remarkable because done by the Senate, in opposition to the House and the recommendations of both the secretary and assistant secretary of agriculture.

While there is much to be done in this direction in future, I cannot let this occasion pass without giving a note of warning. Success will only come in any particular case when exact knowledge is first obtained, and the most thorough scientific methods are then adopted; and we cannot too severely condemn every thing that savors of buncombe and ignorance. During the year, the press of the country has prominently heralded the fact that a gentleman from San Francisco, especially charged to study certain entomological matters in the East, found, while in Washington, the two-spotted ladybird (*Coccinella bipunctata*) feeding on "the spotted *Aphis*" right under the windows of the Division of Entomology of the Department of Agriculture, the inference intended being that the entomologist and his assistants were ignorant of the circumstance. Indeed, a writer in one of the California papers of recent date announced this dis-

covery under the sensational heading "Another Good Bug. — The Woolly Aphis has found its Sedan." How supremely ridiculous this sort of thing appears to the well-informed entomologist I need not tell you, but it may be well for the information of the public to say (as I have not alluded to the matter elsewhere) that a number of different species of ladybirds feed upon the woolly *Aphis*, and that it is a rule with the insects of this family not to be select as to the particular aphid they prey upon. *Hippodamia convergens* (the species referred to as the Sedan of the woolly *Aphis*) feeds, over nearly the whole extent of the United States, upon this particular *Schizoneura*, among others; and the fact that both the species referred to feed upon various *Aphides* is well known. That one of the species is also common upon the Pacific coast, and that its being carried there from the East is like "carrying coals to Newcastle," may not, however, be so generally known. All such efforts as this, carried on by persons unfit, from want of any special knowledge, for the mission, must invariably do harm, not only because of the negative results which follow, but because of the lack of confidence in such work which they will engender in the minds of our legislators.

I should not think of holding any one responsible for newspaper paragraphs; but in this case the party has substantially confirmed them in statements over his own name, and in interviews which (as announced) he has himself revised.

Method of using Bisulphide of Carbon against Grain Weevils.

The use of bisulphide of carbon against different insects attacking stored grain has greatly increased in this country since I first recommended it some thirteen years ago.[1] There is, however, considerable diversity in the methods of using it; and the recommendations of some of our writers have evidently been made with no sense of the fact that the fumes are heavier than air, and descend rather than ascend. Professor A. H. Church, in a recent number of the *Kew Bulletin*, records that he found that a pound and a half of the bisulphide is enough to each ton of grain. He advises that it be applied in the following way:—

A ball of tow is tied to a stick of such a length that it can reach the middle of the vessel containing the grain. The tow receives the charge of bisulphide, like a sponge, and is then at once plunged into the vessel and left there, the mouth of the vessel then being tightly closed. When necessary, the stick may be withdrawn and the charge (of one ounce to a hundred pounds) may be renewed.

The action of carbon bisulphide lasts, in ordinary cases, six weeks, after which period a fresh charge is required. The bisulphide does no harm to the grain as regards its color, smell, or cooking properties; and the germinating power of most seeds is not appreciably affected, provided that not too much is used, nor its action continued for too long a period.

The assistant director of agriculture of Burmah is reported to have used naphthaline instead of bisulphide in the following way, but I should not expect any thing like as good results from the naphthaline as from the bisulphide.

A hollow bamboo cylinder an inch and a half in diameter, with a stick fitted into the cavity, is pushed down to the bottom of the bin. The stick is then withdrawn, and a few teaspoonfuls of naphthaline powder is poured into the bamboo, which is then drawn out, leaving the naphthaline at the bottom of the bin. If the bins are very large, this should be done once to every ten feet square, and the application should be repeated every fifteen or twenty days.

[1] Farmers' Review (Chicago), March, 1879.

Insecticide Machinery.

A profitable hour might be devoted to the subject of insecticide machinery, but I must content myself with a few words. At a trial of such machinery at the Mareil-Marly vineyards during the late Paris Exposition, I had an excellent opportunity of witnessing the latest advances made in France in this direction; and it was extremely gratifying to note, that, with whatever modification of the power employed (and many of the machines were very ingenious), all other forms of spraying-tip had been abandoned for vineyard purposes in favor of modifications of the Riley or Cyclone nozzle. The superiority for most practical purposes, of the portable knapsack pumps of V. Vermorel of Villefranche (Rhône), France, was sufficiently evident. M. Vermorel has identified himself with the regeneration and improvement of French grape-culture in many directions, and is, withal, an enthusiastic student of insect-life. I spent a very profitable day with him last year both at the factory and at his home, where he has established a virtual experiment station in the midst of a fine vineyard on American roots, and with every facility for various fields of investigation, none of which are deemed more important than the work in entomology; for he fully realizes how much there is yet to learn of some of the commonest insects destructive to the vine, even in an old country like France. But in no direction has he accomplished as much good as in his work with insecticide and fungicide machinery. His sprayer with independent pump, his diaphragm pump (L'Eclair), and his reservoir with suction and force pump, are all admirably adapted for the purpose they were invented for, and may be obtained in France at a cost of from five to seven dollars, which is tripled before reaching this country, thanks to our present tariff system.

The Galloway Sprayer.—The last number of the *Journal of Mycology*, the serial publication of the Division of Vegetable Pathology of the Department of Agriculture, gives full description, with figures, of a knapsack spraying-apparatus for which the special merit claimed is cheapness.

The combination of a suction and a force pump with knapsack-reservoir has been frequently made in France, as illustrated by the apparatus styled the "Cyclone" of Vermorel; the Japy, Vigeroux, Nougès, and Perrin sprayers; and the sprayer of the society "L'Avenir Viticole." A number of pumps manufactured in this country of this style were mentioned or described in the "Fourth Report of the United States Entomological Commission." These, in general, are much inferior to the French pumps named, which are, however, modelled after those earlier and cruder forms. There are a host of other French knapsack spraying-machines, which differ from those mentioned by propelling the liquid by means either of air-pumps, diaphragm-pumps, or devices in which the pump is attached to the reservoir by means of a rubber hose.

In 1888 Mr. Adam Weaber of Vineland, N.J., brought out the Eureka sprayer, a very serviceable knapsack pump modelled after the French machines. The French sprayers will cost, including duty, shipping, etc., from eighteen to twenty-five dollars; the Weaber sprayer is sold for twenty-one dollars, which is but little more than the cost of manufacture; Professor Galloway's machine is sold for fourteen dollars, or from a fourth to a third less than the Weaber or the French sprayers.

In the first announcement of this pump in No. 1, Vol. VI.,

—"The Harvard Yard," an original etching by Robert R. Wiseman, shows the "Harvard Yard," with a good view of the group of older buildings. The plate is of large size. No plain prints of the etching are to be had for the present, at any rate, possibly not at all. Each remarque artist-proof is printed on imperial Japan paper, and bears the signature of the artist and a remarque representing the seal of the university, printed in dark crimson. The publishers are the Frederick A. Stokes Company, 182 Fifth Avenue, New York City.

—*Nature* states that a novel whaling expedition is about to be undertaken by three Americans whalers, which have gone to the Arctic regions to winter at the mouth of the Mackenzie River. In order to be well supplied with food, they have taken what will last for two years, and they expect also to get food from the whalers in the summer. This is the highest point any whaler has reached, being a thousand miles from the North Pole. Directly the ice breaks after the winter, the whales come to the mouth of the river in great numbers to feed, and it is expected that a large number of them will be secured.

— A paper by Mr. W. B. Mason in the "Transactions of the Seismological Society of Japan" deserves the attention of all who take special interest in seismology. It contains, according to *Nature* of Dec. 11, a list of earthquakes recorded at telegraph-stations in central and northern Japan from Aug. 11, 1888, to Dec. 31, 1889. Mr. Mason, while allowing for various sources of uncertainty in the observations, thinks that some results may be deduced from what are still meagre statistics. Thus, of the 151 earthquakes recorded in Tokio, only 89 were felt at the other telegraph-stations. Some of those which were felt at all the stations seem to have been felt at almost exactly the same instant: in other words, there was no indication of a progression of the earthquake from point to point.

— Some three years ago MM. Fremy and Verneuil, two French chemists, succeeded in producing rubies artificially. The crystals obtained, says *Engineering*, were small; and since then the inventors have been occupied with the problem of increasing the size of the rubies obtained. To this end considerable changes have been made in their methods of operating. In place of using pure alumina, as in their previous experiments, alumina alkalinized by potassium carbonate is used. This addition of an alkali does not alter the purity of the crystals obtained, while it facilitates their regular formation. In their original experiments the operations were completed in twenty-four hours, but they have now succeeded in prolonging the re-action over several months, with the result of obtaining much larger crystals. As much as seven pounds weight of rubies have been obtained at a single operation. Even yet, however, the crystals are small, but are at least sufficiently large to mount, which was not the case with the first essays of the inventors.

—The curious idea of preserving dead bodies by galvanoplastic method is not new; but we note that a Frenchman, Dr. Variot, has been lately giving his attention to it (*La Nature*). To facilitate adherence of the metallic deposit, says *Nature* (Dec. 18), he paints the skin with a concentrated solution of nitrate of silver, and reduces this with vapors of white phosphorus dissolved in sulphide of carbon, the skin being thus rendered dark and shiny. The body is then ready for the electric bath, which is served by a thermo-electric battery, giving a regular adherent deposit of copper if the current is properly regulated. With a layer of one-half to three fourths of a millimetre, the envelope is solid enough to resist pressure or shock. Dr. Variot further incinerates the metallic mummy, leaving holes for the escape of gases. The corpse disappears, and a faithful image or statue remains.

— Mr. J. M. Coode records, in the new number of the *Journal of the Bombay Natural History Society*, the following instance of an exceptional method of hunting which the panther is occasionally forced to adopt. Mr. Coode was lately asked by the patel of a village in the Amraoti district to accompany him one evening to a forest nursery of young bamboo shoots, to assist in killing a large boar which nightly visited the place and did immense damage. As stated in *Nature*, they waited for some time, when, just as it was getting dark, they heard the short guttural sound of a panther, and heavy footfall of some running animal. The noises came nearer and nearer, until a nilghai and a panther could be distinctly seen against the sky-line, the former being chased by the latter. The nilghai kept moaning, and was evidently in an abject state of fear. The two ran round in a circle of about one hundred and sixty yards diameter, within thirty yards of where the observers were standing, and passed them twice, both animals making their respective noises. They then disappeared, but Mr. Coode has reason to believe the nilghai got away.

— At the last meeting of the Physical Society (London), as reported in the *Electrical Review* of Dec. 19, Mr. Shelford Bidwell, F.R.S., told a great many useful facts about selenium cells and their behavior; and he gave several experimental illustrations, the most effective of which points to practical applications. Mr. Bidwell connected one of his selenium cells with a delicate relay, which in its turn caused a circuit to be established with an automatic switch and an electric lamp. So long as sufficient light impinged upon the selenium, the electric lamp did not act; but, directly the gas (or daylight in practice) diminished to a certain degree, the electric lamp shone forth in its glory, and again became extinguished when its rival re-appeared. The fact of any light going out could thus be signalled to a distant attendant, and this would be useful in case of ships' lights and numerous other purposes. The effect of different colored glass interposed between the light and the cell revealed peculiar results upon the properties of the selenium, and Dr. Thompson suggested that one could almost imagine the near possibility of seeing by electricity if the effects of colors could be transmitted to distances in some analogous manner.

— It is stated in the "Proceedings of the Royal Geographical Society" (December, 1890) that M. Thoroddsen, the well-known explorer of Iceland, has returned to Reykjavik from his summer excursion into the district between Borgarfjord in the south and Gilsfjord in the north. The topography of the country as shown on existing maps was found to be fairly accurate. The geological results of the journey are more novel. The volcano situated at the extreme point of the peninsula of Snaefellenes was visited. It is especially interesting from the fact that clear indications have been found that this volcano commenced its eruptive activity long before the glacial epoch; and, although no outbreak is known to have occurred within historical time, it is tolerably certain that its activity continued to comparatively modern times. The volcanoes of the district traversed have not the same direction as those in the south of Iceland, viz., from south-west to north-east, but range themselves in a semicircle round Faxe Bay, which is a distinctly volcanic depression. M. Thoroddsen's expedition was largely supported by Baron Dickson.

— Some experiments have just been made at Annapolis by the United States Government with the object of testing the resistance of nickel-steel armor-plates at low temperatures. The plate tested, according to *Engineering* of Dec. 12, which had already received five shots under ordinary conditions, was fired at twice more,—once before subjecting it to a freezing mixture, and once afterwards. A 6-inch gun was used with a powder charge of 44½ pounds, and a Holtzer shell weighing 110 pounds, the striking velocity being 2,055 feet per second. The first shot struck 15 inches from the edge of the plate, and the projectile penetrated till its point entered the wood backing, reaching a distance of 13½ inches from the face of the plate. The shell rebounded, and was picked up entire at a distance of 40 feet from the plate. The plate showed a crack 14 inches long extending down to the left edge of the plate, and another horizontal crack 13 inches long, both of which were apparently through cracks. The plate was then put in a freezing mixture of ice and salt, and its temperature reduced to 28° F. The second shot was then fired, the conditions being similar in all respects to the first. The shell, however, broke up badly, about one half remaining on the plate, and the other half flying to fragments. A triangular piece of the plate, 26 inches across the top, broke off, and was thrown 25 feet in front of the plate. A wide gaping crack connected the hole with

one of the shot-holes previously made in the plate. Numerous old cracks were opened and enlarged, and other new ones made, the longest being 24 inches. With the exception of two cracks, the injury to the plate was in the neighborhood of previous fractures. The perforation of the two rounds was much the same.

— The Swedish expedition to Spitzbergen under the leadership of G. Nordenskiöld and Baron A. Klinkowström returned in safety to Tromsö, as we learn from the "Proceedings of the Royal Geographical Society." The party landed first of all at Horn Sound, whence G. Nordenskiöld made his way on snow-shoes overland to Bel Sound; but the deep snow prevented geological work. The longest stay (July 18 to Aug. 10) was made at Ice Fiord. The farthest point north reached was Lagö, east of Hinlopen Straits. The passage was still quite blocked with ice, and, there being but small chance of being able to penetrate to the Seven Islands, the return voyage was commenced. On their way back, the travellers made hydrographical explorations on the Norwegian islands.

— Professor Brückner of Berne, Switzerland, has recently called attention to the existence of climatological periods of about thirty-five years for the whole globe (more marked in the interior of continents). The years 1700, 1740, 1780, 1815, 1850, and 1880, says *Nature* of Dec. 18, appear as centres of cold, wet periods; while the years 1720, 1760, 1795, 1830, and 1860 are centres of warm, dry periods. During the warm periods the passage of oceanic air to the continent has been hindered, and during the cold it has been favored, increased rainfall occurring in the latter case.

—We learn from *Engineering* of Dec. 12 that Mr. P. Schoop, of the Oerliken Electrical Works (Switzerland), with the object of rendering accumulators more portable, has adopted the plan of absorbing the electrolyte with gelatinous silica. With this object. Mr. Schoop adds a small quantity of sodium silicate to the cell. This is decomposed by the sulphuric acid, and the silica is liberated in the form of a translucent, firm, and elastic jelly, which is unattacked by sulphuric acid, or by the more powerful oxidizing agents which come into existence during the charging. The jelly but slightly increases the resistance of the cell, though it somewhat diminishes its capacity in watt hours. The best method to adopt in gelatinizing a cell is to add to three volumes of sulphuric acid, at a density of 1.25, one volume of sodium silicate at a density of 1.18, and leave the mixture to itself for twenty-four hours. At the end of that time the whole liquid is set to a jelly. In charging a cell, a small quantity of liquid rises to the surface of the jelly, but this disappears again during the discharge.

— The French Government have had carried out for them a number of experiments on gun-steel at very low temperatures. Both hardened and unhardened specimens were subjected to a variety of tests at temperatures of between 75° and 100° below the zero of the Fahrenheit scale. The specimens were cooled, according to *Engineering*, by immersing them in a bath of solid carbonic-acid gas and sulphuric ether, several pounds of the gas being required for this purpose. The first set of tests were simply intended to determine the expansion of the test bars per degree; and the results, though somewhat irregular, showed that the expansion per degree decreases with the temperature. A number of test bars were then prepared in sets of threes, two of each set being used as reference bars, and tested at the temperature of the surrounding air, while the third was cooled down to between 75° and 100° below zero, and then tested, with the following results: both the hardened and unhardened bars had their elastic limit raised by about 11 per cent by being tested cold; the breaking load of the unhardened bars was raised about 3 per cent, and that of the hardened by about 6 per cent, by the cooling; the elongation of the unhardened bars was diminished 12 per cent, and that of the hardened ones 14 per cent; the contraction of area was also less in the bars tested cold. None of these changes are, however, permanent, as the bars completely recovered their original properties on attaining the ordinary temperature of the air. All the above tests were made in tension in the usual way. For gun-steel, however, the resistance of the metal to shock is of more importance than its strength under a quiet tensile stress. A number of bars were accordingly prepared in sets of threes, as before, and one bar of each set was cooled down to between 75° and 100° below zero, and tested by means of a falling weight, the other bars of each set being tested in the same way at the ordinary temperature. The experiments showed that cooling the bars much increased their brittleness. Thus, on an average, each unhardened bar required 5.9 blows to break it when cooled, as against 14.6 blows for specimens tested under ordinary conditions. With the hardened bars, the reduction in strength was less, 12.57 blows being required as an average at the low temperature, and 14.4 at the ordinary temperature. As before, the metal regained its qualities as its temperature rose. Some further experiments seemed to show that metal into which a great deal of work had been put was less affected by a reduction in temperature, but this requires confirmation.

— According to the *Journal de la Chambre de Commerce de Constantinople*, the greatest electric project which has yet been suggested is being planned,—the construction of a line from St. Petersburg to Archangel. The electric current would be supplied by a series of generating stations distributed along the line. It is estimated that the cost, including the rolling stock, would be 46,509 francs per kilometre.

—*Nature* states that at a recent meeting of the Paris Academy of Medicine, M. Motais of Angers maintained that myopia, or short-sightedness is one of the products of civilization. An unexpected proof of this view was found in the condition of the eyes of wild beasts, such as tigers, lions, etc. M. Motais, having examined their eyes by means of the ophthalmoscope, discovered that animals captured after the age of six or eight months are, and remain, hypermetropic, while those who are captured earlier, or, better still, are born in captivity, are myopic. This short-sightedness is evidently induced by artificial conditions of life.

— On Monday, Dec. 15, Mr. T. G. Pinches read a paper before the Royal Asiatic Society, on the newly discovered version of the story of the creation. He had had the good fortune, in the course of his investigations into the contents of the unregistered tablets in the British Museum, to find in one of them, brought home by Mr. Rassam in 1882, a still earlier version than that which the late Mr. George Smith had translated. It was a bilingual tablet, the text being Akkadian, and the gloss Assyrian; and while the date of the tablet itself was, like the rest of those in Assur-bani-pal's library, not older probably than 650 B.C., the Akkadian text was, in his opinion, an exact copy of an older document, which had, in all probability, been put into its present shape 3000 B.C., or even earlier. One side, the obverse, as described in *Nature*, is devoted to the creation story: the other, the reverse, is simply an incantation form for the purification of the great temple tower E-zida, now so well known as the mound called Birs-Nimrud. The text might be roughly divided into three paragraphs or sections of about ten lines each. The first describes the time when nothing was, neither "the glorious house of the gods," nor plants, nor trees, nor cities, nor houses, no, not even the abyss (Hades) nor Eridu (regarded by the author as Paradise). The second section describes the making of Paradise with its temple tower E-Sagila, founded within the abyss. Then was Babylon made, and the gods, and the land, and the heavens, and mankind. The third section then proclaims the creation of animals, plants, and trees (in that order) of the Tigris and of the Euphrates. The fourth records the building of cities and houses. Of all except the last, Merodach, the god, seems to be the active creator, and he is also to be understood as the builder, through men, of the cities, etc. Mr. Pinches pointed out several interesting words and forms occurring in this oldest form of the creation account, which had subsequently assumed so many diverging shapes. A discussion followed, more especially on the word "Adam," rendered by Mr. Pinches "foundations" (of earth), but by Dr. Zimmern "living things." This was probably the origin of the Hebrew word "Adam."

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LETTERS TO THE EDITOR.

[Continued from p. 5.]

The Subtropical Zones of High Barometric Pressure.

There is an old theory, if a mere popular notion which has no scientific basis whatever may be so called, that the two zones of high barometric pressure, extending with a few interruptions around the globe, and having their maxima of pressure about the parallel of 35° in the northern hemisphere, and 30° in the southern, are caused by the crowding of the air, in its passage in the upper part of the atmosphere from the equatorial to the polar regions, into intermeridian spaces, becoming gradually narrower toward the poles. It is supposed that the air, as it is forced into narrower spaces, is turned down toward the earth's surface, and that this descent of the air causes increased pressure on the surface. The barometric pressure in both hemispheres increases from the poles, or at least from some high parallel, toward the equator, until the parallels above mentioned are reached, and then there is a small decrease of pressure to the equator; so that these parallels are simply the limits between the increasing and decreasing pressure gradients in going from the pole to the equator, and the culminating parallels of the convexity of the isobaric surfaces.

The writer's attention was first directed to this feature of these isobaric surfaces about thirty-five years ago, in reading Lieut. Maury's "Physical Geography of the Sea;" and, having no faith in the popular explanation, he made it a matter of study in order to discover the true cause. This was found in the now well-known law of the deflecting force of the earth's rotation, which was first discovered at that time. By this law the air, in moving from west to east in the middle and higher latitudes, is pressed toward the equator; but, in moving the contrary way in the lower latitudes, it is pressed a little toward the poles, thus causing a bulging-up of the isobaric surfaces with the culminating lines between the two systems of easterly and westerly currents about the parallels of 35° or 30°. The results were published in an "Essay on the Winds and the Currents of the Ocean," which was subsequently republished in "Professional Paper of the Signal Service," No. XII.

Subsequently this whole subject was treated in a more thorough and mathematical manner, and the results were published in a memoir entitled "Motions of Fluids and Solids Relative to the Earth's Surface." This was afterwards republished in "Professional Paper of the Signal Service," No. VIII., with extensive notes by Professor Frank Waldo. In this memoir it was shown that with certain assumed values for the velocities of the easterly and westerly motions of the air, which were quite reasonable and probable from what was known of these somewhat uncertain data, the deflecting force of the earth's rotation would give the observed increase of pressure, on the one hand from the pole, and on the other from the equator; so that there was no room to doubt that the maximum pressure a little above the tropics in each hemisphere was caused by this force. A very full abstract of this memoir was also given in *Silliman's Journal*, January, 1861.

Subsequently this same subject was taken up again, and treated in a more thorough manner and with better data, and the results published in "Meteorological Researches," Part I., "Coast Survey Report for 1875."

The same subject was again treated by the use of mathematical processes somewhat simplified, and given in "Recent Advances in Meteorology," forming Part II. of the "Report of the Chief Signal Officer for 1885."

Finally the whole matter was gone over again by the writer in a popular manner, and explained by means of various simple illustrations, and was given in his "Popular Treatise on the Winds," etc.

Dr. Hann, however, has not accepted the results, nor has he ever attempted to show that they have been deduced from erroneous principles or processes, but has continued to use and uphold the old theory. Not only this, but he has based upon it a new theory with regard to the cause of the high-pressure areas of the middle and higher latitudes. In the *Zeitschrift für Meteorologie* for 1879, p. 39, he first suggests that these regions of high barometric pressure may be simply the places where the upper equatorial and westerly currents settle down towards the earth's surface, as in the case of the zones of high pressure at the polar limits of the trade-winds. His idea is, that as the upper poleward-moving currents in the latter are deflected down by their being crowded between intermeridional spaces, gradually becoming narrower toward the poles, so, even beyond these belts of high pressure, there must be local hinderances, or a damming-up of these currents, by which they pass into descending ones toward the earth, and so cause the high-pressure areas.

In the next volume of the *Zeitschrift* he again refers to this matter, and suggests that the reason why cyclones and great barometric disturbances are more frequent in winter than in summer is that in winter the temperature and pressure gradients of the upper strata of the atmosphere, in a poleward direction, are greater, and hence there is a greater strength of current at this season of the year.

Again, in his "Climatology," published a few years ago, this same old theory is given in explanation of the subtropical zones of high pressure.

Finally, in his recent memoir published by the Royal Academy of Sciences of Vienna, the old theory of the subtropical high-pressure belts is introduced, and also his new theory, deduced from it, of the causes of high-pressure areas; and he refers to his preceding papers in the *Zeitschrift* on these subjects.

Although the teaching of Dr. Hann on these subjects has been entirely at variance with the writer's own views on the same subjects, previously published at so many different times, yet he has

refrained from taking any notice of it. But now that this last memoir has recently been brought to the attention of English, and especially of home, readers, justice to himself requires that this matter shall not be allowed to remain unnoticed any longer.

The question of the cause of the high pressure in the subtropical zones, according to the old theory, is one of the relation between kinetic and potential energy; that is, between velocity and pressure. As the air of the upper part of the atmosphere moves toward the poles, it is supposed to become crowded and checked in its motion, and the kinetic energy changed to pressure. But the question arises as to why this takes place up to a certain latitude only, that of maximum pressure, and not all the way up to the poles; for the maximum velocities of the upper poleward-moving currents must be a little above this latitude, and the converging of the meridians increases up to the pole. As long as kinetic energy is changed to pressure, this must be increased; and so the greatest pressure must be at the pole, and not down at a low latitude. But it may be shown that the whole effect is so extremely small, that it is not worthy of any consideration practically.

The following general expression of the relation between pressure and velocity is taken from "Recent Advances in Meteorology," p. 194:—

$$(1) \quad \log P_0 - \log P = \frac{h}{18401\,(1 + .004\tau)} + \frac{s^2 - s_0^2}{360940\,(1 + .004\tau)},$$

in which P is the barometric pressure in millimetres of any part of the air with corresponding velocity s; P_0 equals 760 millimetres, being taken as the value of P at the earth's surface, and the corresponding value of s equals s_0; h is the difference of altitudes corresponding to P_0 and P; and τ is the temperature by the Centigrade scale. If u, v, and x are the meridional, longitudinal, and vertical velocities respectively at any given point, we have

$$(2) \quad s^2 = u^2 + v^2 + x^2.$$

The numerical constants in (1) are adapted to common logarithms, and the expression is strictly applicable to the case only in which τ is constant and in which friction may be neglected.

The first term in the second member of (1), depending upon h, arises from gravity. Where only small portions of air are considered, or strata of very small depths, the part of the pressure depending upon h is so small in comparison with the whole atmospheric pressure, that it may be neglected, and the expression may then be put into the following form:—

$$(3) \quad P_0 - P = \frac{s^2 - s_0^2}{206\,(1 + .004\tau)}.$$

This is substantially the same, in different measures and notation, as that of Kaemtz (*Lehrbuch der Meteorologie*, vol. i. p. 150), when used at the earth's surface, where $p' = 760$ millimetres.

In the application of the preceding expressions it is necessary to know the value of s_0 corresponding to P_0; but this is known in a few special cases only, since we do not have a complete solution of the dynamic problem of the general circulation, in which the condition of continuity and the frictional conditions are taken accurately into account. It is also necessary to know the stream-lines, since P and P_0 must be in the same stream-line.

It is evident from the observations of the cirrus clouds at Zi-ki-wei (latitude 31° 12′ north) that the velocity of the poleward-moving current of the upper part of the atmosphere at this latitude cannot be more than about two metres per second, or four miles and a half per hour (see *Popular Treatise on the Winds*, etc., p. 122). Let us now suppose that there is a perpendicular wall on the parallel of 35° extending all around the globe, and reaching up to the top of the atmosphere, and that the whole upper half of the atmosphere has a motion, from some cause, directly against this wall, with a velocity u. The current in this case will pass directly down to the earth's surface, where, near the wall, we must have sensibly $s_0 = 0$. Supposing, now, that $P_0 = 760$ millimetres when the whole atmosphere has no meridional component of velocity, and that $\triangle P_0$ is the effect of the upper current: we get from (1), in this case,

$$(4) \quad \log (760 + \triangle P_0) = \log 760 + \frac{u^2}{360940\,(1 + .004\tau)}.$$

Putting $u = 2$, and $\tau = 0$, this gives $\triangle P_0 = .0194$ millimetres, or about .00076 of an inch of barometric pressure. The increase of barometric pressure in the high-pressure belt, above the normal pressure, is about 0.3 of an inch. So the old theory, even upon the extreme supposition that the whole kinetic energy of the upper current is converted into pressure in the high-pressure belt, accounts for only about the $\frac{1}{400}$ part of the observed increase of pressure in this belt. When we consider, then, how small a part of the kinetic energy of the upper current is changed to pressure, and that the most of it passes on to higher latitudes, how extremely small must we suppose the effect from the old theory to be!

Where there is friction, of course some of the kinetic energy is changed into heat, and so the pressure is accordingly diminished; and a little greater velocity would be required to cause the same increase of pressure.

In what precedes we have supposed the kinetic energy to have its origin from some other source than a pressure gradient; but in the interchanging motions between the equatorial and the polar regions, toward the pole above, and the contrary below, this is not the case, but the pressure must decrease from the equator to some middle latitude where the velocity u and kinetic energy are the greatest, and then increase from that to the pole, where it is 0 and the pressure the greatest. The preceding formula is applicable in this case at the equator and the poles, since $s_0 = 0$; and, putting $u = 2$ metres per second, we get $\triangle P_0 = .0194$ millimetres, as before. If we suppose P_0 to be in the latitude where $u_0 = u$, that is, where the velocity of the return current is the same as the maximum velocity u above, then, instead of u^2 in (4), we have $u^2 - u_0^2 = 0$, and hence we get $\triangle P_0$ in this case equal 0; that is, there is no change of pressure here arising from the interchanging motion between the equator and the pole. The pressure, therefore, is a little greater at the equator and the poles than at the latitude where u is a maximum, which, on account of the convergency of the meridians, and the narrowing of the intermeridional spaces, toward the poles, is between the middle latitude and the equator, and perhaps near the parallel of 35°. Instead, therefore, of an excess of barometric pressure here of about 0.3 of an inch, there should be a very slight depression, if there were no other forces to cause this excess. And this is very evident from a very simple manner of considering the matter: for as long as the air, in moving from the equator, is acquiring increased velocity, there must be a descending pressure gradient; but, as soon as there is a decrease of velocity, there must be an ascending gradient to cause it. The same is true in the lower strata of the atmosphere, where the air returns from the polar to the equatorial regions. The oscillations of the air-particles between these regions are similar to those of a pendulum, in which the force from both sides acts in the direction of the middle point.

With regard to the effect of descending currents, to which Dr. Hann ascribes the local high barometric pressures of the middle and higher latitudes, already referred to, the formula (4) can be applied in this case also. We have only to substitute for u the vertical component of velocity x. This being done, we can readily compute what the value of x must be to give $\triangle P_0$ equal to any assignable value. Let us suppose it is required to find what value x must have to give $\triangle P_0 = 25$ millimetres; that is, an increase of barometric pressure of about one inch. We can, in this case, assume $s_0 = 0$, at least in the middle of high-pressure area. The formula in this case gives $x = 71.2$ metres per second, or about 160 miles per hour, if we put $\tau = 0$ in the formula. For a higher temperature this velocity must be greater.

If any one is disposed to doubt this result given by the formula, let him take the experimental result obtained by Mr. Dines and others, that a velocity of about seventeen miles per hour gives a pressure of one pound per square foot upon a plate exposed at right angles to the current. But the pressure of the whole atmosphere, corresponding to 30 inches of mercury, is about 2,100 pounds. The pressure corresponding to one inch, therefore, is 70 pounds. As the pressure is as the square of the velocity, we must have $x = 17 \times \sqrt{70} = 142$ miles per hour, to give a pressure equal to one inch of barometric pressure. This result is less than that obtained theoretically, because it is well known that the experimental pressure upon a small plate is greater than the theoretical, on account of the effect of friction of the air which passes around

the plate, both upon the air which is retarded and stopped in front of the plate, and also upon that behind the plate.

It is doubtful whether a descending current in the open air of more than two metres per second could be found anywhere in the whole atmosphere. This, we have seen, would increase the barometric pressure 0.0194 of a millimetre, a quantity which could not be detected by the most delicate and accurate barometer. It is seen, therefore, how very improbable is Dr. Hann's theory of the cause of high-pressure areas.

Dr. Hann lays great stress upon the efficiency of the steep gradients of the upper part of the atmosphere, in the middle and higher latitudes, in producing both cyclones and high-pressure areas. But the forces arising from these gradients are almost completely counteracted by the deflecting forces of the earth's rotation in connection with the eastwardly moving currents in these latitudes, the velocities of which increase with increase of altitude very nearly in the same proportion as the steepness of the gradients. Although the steepness of these gradients at high altitudes, especially in the southern hemisphere, is considerable when considered with reference to gravity simply, yet, if all the forces are taken into account, there is no part of the atmosphere in the middle latitudes where the gradients are smaller, the velocity of the easterly motion being such as to not quite counteract the force from the gradients, and to leave a residual force simply which is sufficient to counteract the frictional resistance in these high altitudes, which is very small. It would be just as reasonable to maintain that there is a strong tendency in the water of the ocean to rush toward the poles, because there are steep gradients, considered with reference to the earth's attraction only, and leaving out of consideration that the centrifugal force arising from the earth's rotation counteracts this tendency, as to maintain that the air in these high altitudes has a strong tendency to rush toward the poles. WM. FERREL.

Martinsburg, W.Va., Dec. 22.

Recent Investigation on the Causes of Cyclones and Anticyclones.

IF I were required to name the man who impressed me as the most profound meteorological writer whom I had read, I should without hesitation say Professor Ferrel.

The most of us are qualitative meteorologists: he may be called a quantitative meteorologist. Not content with mere general statements of causes and forces, he attempts to determine the exact value of each one, and by rigid mathematical formulæ to determine if they are sufficient to account for the given results.

This represents a high, if not the highest, development of a scientific mind. For this reason I would hesitate to dissent from Professor Ferrel's conclusions more than from any writer I know; but he has himself, in his recent letter to *Science*, severely criticised the supposed blind following of authority, and, if there were needed any excuse, I would give this as the reason for presenting the views opposed to those of Ferrel.

There are two methods of arriving at results. The one is by deduction, in which the thinker, starting from axioms, well determined constants, or general laws, works out the results which must follow. The other is by induction, in which the thinker starts from observation, or separate individual facts, and arrives at general laws. Both methods are necessary; and most thinkers of to-day will admit that no theory of natural phenomena is complete until the results of deductive reasoning correspond to the results of inductive reasoning, or *vice versa*.

Now, Ferrel is essentially a deductive reasoner. It is necessary in such reasoning that the fundamentals, or physical constants from which one starts, should be correctly determined. In Ferrel's and Marvin's replies to Hazen in *Science* and in the *American Meteorological Journal*, I believe it has been shown that the constants forming the basis of the calculation in Ferrel's condensation theory of cyclones were satisfactorily determined. Starting with these, and following Espy, he has shown, that, given a warmer body of air, or a rapid vertical decrease of temperature over a considerable area, the causes are adequate to initiate and maintain a cyclone.

The question now is, do the investigations of inductive meteorologists sustain these views?

In order to study the results which follow rapid vertical decrease of temperature in the atmosphere, Loomis "selected from the volumes of the published observations of the Signal Service (November, 1873, to January, 1875, and from January, 1877, to May, 1877) all of the cases in which the temperature at Pike's Peak was 40° lower than at Denver." With this difference between them, the air would theoretically be in unstable equilibrium. "The number of these cases in twenty months of observation was 343. Only 39 of these cases occurred during the seven winter months of observation, and they occurred most frequently during the months of May. . . . The facts appear to show that at the dates given there were seldom any extraordinary disturbances on Pike's Peak. In two cases hail was reported, in four cases sleet and in fifteen cases either rain or snow. These facts seem to indicate an occasional uprising, but it is remarkable that so few such cases occurred; and it will be noticed that a difference of temperature of at least 45° between Pike's Peak and Denver often continued from day to day for long periods. . . . I think we may hence infer that dry air, even when greatly heated, has but little ascensional force" (Loomis's "Contributions to Meteorology," 13th paper, in *American Journal of Arts and Sciences*).

Loomis also found that heavy rainfall was not necessarily productive of cyclones. In his sixth paper, after examining a large number of cases, he says, "We conclude, therefore, that great rainfalls do not generally continue over eight hours, and very rarely do they continue for twenty-four hours, either as experienced at one station, or in succession at different places." He arrives at the same conclusion in his seventh and seventeenth papers, and adds, "The forces which impart that movement to the air which is requisite to an abundant precipitation of vapor, instead of deriving increased force from a great fall of rain, rapidly expend themselves, and become exhausted."

Furthermore, after examining a large number of areas of low barometric pressure with which there was little or no rain, he says, "There seems to be no room for doubt that barometric minima sometimes form with little or no rain, and continue without any considerable rain for eight hours, and sometimes for twenty-four hours or longer; . . . so that it seems safe to conclude that rainfall is not essential to the formation of areas of low barometer, and is not the principal cause of their formation or of their progressive motion."

"In order to determine the circumstances under which storms originate and ultimately acquire their full intensity," Loomis selected thirty-six cases from the Signal Service weather-maps in which the storm appeared to develop in the United States, and, as a result of a study of these, says, "The first stage in the development of each of these storms was an area several hundred miles in diameter, over which the height of the barometer differed but little from thirty inches, with an area of high barometer both on the east and west sides, and at a distance of about 1,000 miles. In the few cases in which a high barometer is not reported on both sides of the origin, it is because the area of observation is not sufficiently extended. The mean value of the barometer on the east side was 30.42 inches, and the mean distance 1.033 miles; on the west side the values were 30.31 inches and 977 miles. . . . On Hoffmeyer's storm-charts we frequently find three areas of high barometer surrounding an area of low barometer. These areas of high barometer are regarded as one of the causes, and generally the most important cause, of the storm which succeeds. . . . Since the air presses in on all sides towards this area of low barometer, the area tends to assume an oval form, which may become sensibly circular if the winds are very violent, and the centrifugal force resulting from this revolving motion causes a still further reduction of the barometer. . . . Rain is one of the circumstances which increases the force of a storm, and it invariably attends storms when they have attained considerable violence. . . . Some rain was invariably reported whenever the barometer fell below 29.4 inches, and generally there was some rain reported whenever the barometer fell below 29.5 inches. I have found no storm of great violence which was

not accompanied by a considerable fall of rain" (Loomis's eighth paper).

As early as 1876 Hann found, from the observations on the alpine peaks, that the highest temperature in the upper air occurred with the highest pressure, and explained it as due to the dynamic heating of descending air.

In 1886 Dechevrens showed that on the European peaks Pic du Midi and Puy de Dome, and on Pike's Peak in the United States, the lowest temperature occurred with the lowest pressure, which was exactly the opposite of observations at sea level. He also gave an example of simultaneous observations at the base and summit of the Puy de Dome during a low and during a high pressure, as shown by the barometer at both stations. At the base the temperature was highest with the low pressure, but at the summit the lowest pressure and temperature occurred together (*American Meteorological Journal*, August, 1886).

In the *American Meteorological Journal* for May, 1886, Mr. Dewey stated that from thirty-four pairs of observations during the winter months of 1872 and 1873 he found the average difference of temperature between Burlington, Vt., and the top of Mount Washington to be 6.6° F. when the latter was within a hundred miles of the centre of an anticyclone. The normal difference between the two stations is 19°. In the different quadrants of the anticyclone he found the following differences: north, 9°; east, .0°; south, 4.5°; west, 12.2°; average, 9°. He found the average difference two degrees greater in cyclones. Hazen's results for Mount Washington and Burlington, however, differ from these (*American Meteorological Journal*, October, 1887), so that further comparisons are needed.

In a footnote to an article on the origin and development of storms in the *American Meteorological Journal*, September, 1886, I cited the following reasons for thinking that warmer air is not the essential condition of storm-formation: "Storms sometimes originate along the eastern Rocky Mountain slope when the temperature of the air is lower there than in any part of the United States (for an example see the Signal Service charts of Jan. 19 and 20, 1886), and storms appear to orginate in this region as often in the night as in the day."

Very recently Hann has investigated the temperature observations at numerous stations in the Alps during the passage of several cyclones (*Meteorologische Zeitschrift*, September, 1890), and has concluded that the temperature of the air-column as a whole is lower in cyclones than that of the surrounding air. Hann's investigations may not be conclusive for reasons stated by Ferrel, but they certainly add a link to the chain of evidence.

As a result of their investigations, Loomis and Hann both decided that cyclones were largely the result of mechanical causes. Loomis concluded that they were originated by the conflicting winds between two or more anticyclones, and Hann suggests that they are whirls originating in the upper air.

Now, I think Ferrel, in his recent letter to *Science*, unintentionally did Davis an injustice by suggesting that Davis had suddenly altered his opinion merely because Hann advanced these views. Davis has for years been the leading exponent in this country of the dynamical heating of the air in anticyclones, and during recent years I have several times spoken with him about the mechanical origin of cyclones; and, if he is now inclined to give these views more weight, it is because this last link in the chain of evidence has convinced him of the necessity of reconsidering the condensation theory.

I have for several years been convinced that mechanical action had much to do with the origin and development of cyclones, and as working hypotheses in making weather-predictions have carefully watched the following conditions as favorable for the production of cyclones: 1. The central region between approaching anticyclones. 2. The region where lower air-currents set in nearly opposed in direction to upper air-currents, so as to favor the production of a whirl. This latter condition is most frequently brought about in the United States when colder winds, moving from the north-west near the earth's surface, set in to the south or south-west of an area of high temperature or very high pressure, which give rise to upper currents moving from the south. This was the condition preceding the origin of the very violent storm of March 12, 1888. 3. The deflection of air-currents by a long, tall range of mountains, such as the Rockies. I have several times predicted the origin of cyclones under these conditions. One of these was on April 19, 1883.

I have found the following conditions favorable to the increase of energy in cyclones: 1. The meeting of cyclones moving from nearly opposite directions; 2. The closing-up of a long trough of low pressure by the pressure increasing at both ends; 3. Cyclones, being mainly controlled in their movements by upper air-currents, are sometimes carried by these toward areas of denser air near the earth's surface, and under these conditions tend to increase in energy. Examples of violent storms, developed, as I think, by these mechanical methods, will be found on the following dates: Oct. 14, 1886; Jan. 9, 1889; and Jan. 9, 1886.

The immense gain that would come from being able to anticipate this class of storms may be inferred from the fact that not one of those I have mentioned in this paper was heralded by our Weather Service in time to be of any use, though the amount of damage done was enormous.

The views I hold are, that differences of pressure result from differences of temperature over immense areas, as between equator and pole, ocean and continent. This distribution of pressure is modified by the effect of the earth's rotation, and is continuously varying with the changes in temperature of the air.

The smaller cyclones and anticyclones of our weather-maps are partly or chiefly brought about by the mechanical action of counter-currents in the manner previously explained, though greatly modified by local differences of temperature and density within the cyclone: in other words, they are caused by forces originating outside their field of origin instead of within it, as supposed by Ferrel.

General rains are chiefly the result, and not the cause, of ascending currents of air. Differences of pressure in the upper air have a very important bearing on the origin and development of cyclones. Well-defined areas of low pressure, accompanied by precipitation and an inward tendency of the upper wind, occasionally exist in the upper atmosphere without being indicated by the barometric pressure at the earth's surface.

I have held most of these views for several years, as will be found by my review of Loomis in the *American Meteorological Journal*, and by two articles in *Nature* on the origin of anticyclones, and the cause of precipitation (*Nature*, vol. xxxvi. 1887, and vol. xxxviii. July, 1888), and have hoped to make some quantitative estimates of the forces and supposed causes; but I have not had the time, and fear I have not the ability to do so.

I trust Professor Ferrel will not dismiss these as vague hypotheses unworthy of notice, but will tell us (1) whether the method suggested by Loomis is insufficient to generate a cyclonic whirl according to mechanical principles; (2) whether conflicting air-currents can be supposed to have sufficient inertia to aid in producing a whirl, as, for instance, when denser air sets rapidly inward from both ends of a long trough of low pressure; and (3) whether such cyclones as that of Jan. 20, 1886, which originated near the longitude of Denver, where the temperature was lower than in any other part of the United States, when the observations on Pike's Peak showed no vertical decrease at all between the summit and base of the mountain, and when there was no appreciable precipitation within a thousand miles of the place of origin, could be explained by any reasonable assumption of a higher mean temperature of the air-column within the field of the cyclone.

H. HELM CLAYTON.

Blue Hill Observatory, Dec. 29.

BOOK-REVIEWS.

Handbook of Problems in Direct Fire. By JAMES M. INGALLS. New York, Wiley. 8°. $4.

THIS book, which is believed to be the first of its kind ever published, shows the close attention now given to what may be called the scientific side of modern warfare, or, rather, of preparation for war. It is devoted wholly to problems in gunnery involving the use of ordinary service charges of powder and angles of elevation for the guns not exceeding 15°, which is the definition of

"direct fire." The author of the book, Capt. Ingalls of the First Regiment United States Artillery, instructor of ballistics at the United States Artillery School, has already given to the public two works on the same subject,—"Exterior Ballistics," and "Ballistic Machines." This work was prepared while the author was engaged in teaching ballistics to student officers at the artillery school at Fort Monroe, and most of the examples are such as were given out from time to time to classes under his instruction, as exercises in ballastic formulæ. It will prove to be of permanent value, not only to the particular branch of the service for which it was intended, but also for other branches, both regular and militia. The most important of the examples may be worked out with a very slight knowledge of mathematics, arithmetic and a little algrebra being sufficient for many of them.

AMONG THE PUBLISHERS.

IN *Lippincott's Magazine* for January, 1891, we note "The State of Washington," an article by Major Moses P. Handy, which will surprise the many who know little of this section of the country; and "The Road Movement," an article by Lewis M. Haupt, C.E., which contains some suggestions for the much-needed improvement of public roads.

— Messrs. Houghton, Mifflin, & Co. announce a new edition of Mr. Lowell's "Fable for Critics" This poem, in which all the prominent American authors of the period at which it was written are reviewed with keen appreciation mingled with good-natured banter, Mr. Lowell composed when he was under thirty years of age. "This *jeu d'esprit*," says Mr. Lowell in a prefatory note, "was extemporized, I may fairly say, so rapidly was it written, purely for my own amusement, and with no thought of publication. I sent daily instalments of it to a friend in New York, the late Charles F. Briggs. He urged me to let it be printed, and I at last consented to its anonymous publication. The secret was kept till after several persons had laid claim to its authorship." There are twenty-six authors mentioned in the poem, and the publishers have made the book more interesting by securing portraits of each of these writers, taken about the time the original edition was published. These are reproduced in outline, and are inserted in the text at the point where each author is mentioned. A list of the authors alluded to is also given for the first time, so that the surmises to which the fable has always given rise will at last be set at rest.

— The first number of *The Bacteriological World*, edited by P. Paquin, M.D., Columbia, Mo., has appeared.

—A paper on the "Echinoderms from the Northern Coast of Yucatan and the Harbor of Vera Cruz," by J. E. Ives, assistant to the curator in charge of the Academy of Natural Sciences of Philadelphia, is published in the "Proceedings of the Academy of Natural Sciences of Philadelphia," Sept. 30, 1890. The *Echinodermata* which form the subject of this paper were collected on the northern coast of Yucatan and at Vera Cruz, in the spring of the present year, by an expedition from the Academy of Natural Sciences of Philadelphia to investigate the natural history of Yucatan and Mexico. The results in this department are interesting. One new genus and three new species are described, a little-known species is figured for the first time, the synonymy of this species and of some others has been studied with profitable results, and the majority of the species collected supply new localities which form connecting points between the northern and southern portions of the great West Indian, or eastern tropical American littoral fauna. The northern coast of Yucatan possesses a sandy beach largely made up of shell fragments. The water off the coast is very shallow, the ten-fathom line being twenty miles from the shore, and the hundred-fathom line about one hundred and fifty miles. Three miles off the shore in the neighborhood of Progreso, the bottom is of a sandy character, although

a few small corals were brought up in the dredge. Along the shore to the westward of Progreso is a small serpuloid reef.

— Messrs. Ginn & Co. announce as ready "Quintus Curtius," the first two extant books, edited for sight-reading by Dr. Harold N. Fowler of Phillips Exeter Academy, with an introduction on reading at sight by Professor James B. Greenough of Harvard College. This book has been preferred on account of the conviction of the editor that for practice in sight-reading some continuous prose narrative not readily accessible in a copiously annotated edition should be in the hands of the pupil. The notes of this edition are confined to translations of unusual or striking words and phrases, with occasional brief hints concerning syntax, the main object of which is to save time in the class-room. In the introduction, Professor Greenough shows by examples the method to be pursued in reading at sight, besides explaining fully his ideas on the subject.

—The twenty-fifth volume of the *Magazine of American History* is opened with the January number. The leading illustrated paper for the month, from the pen of the editor, is entitled, "John Ericsson, the Builder of the 'Monitor,'" and a portrait of the inventor forms the frontispiece. The second article following, "The Bladensburg Duelling-Ground," near Washington, written by Milton T. Adkins, is also illustrated. The Georgia historian, Col. Charles C. Jones, jun., contributes a paper on "Dr. Lyman Hall, Governor of Georgia in 1783, and Signer of the Declaration of Independence;" Hon. Charles Aldrich of Iowa writes of the eloquence of Andrew Johnson; Hon. James Phinney Baxter, president of the Maine Historical Society, contributes "Isaac Jogues, A.D. 1636," a poem; Orrin B. Hallam gives the reader a history of the original treasury accounting office; and we have the first part of "Count de Fersen's Private Letters to his Father, 1780–1781," which are the observations and opinions of an officer under Rochambeau in the French Army during the Revolutionary war, translated from the French by Miss Georgine Holmes. Among the Shorter papers, "The United States Flag," by J. Madison Drake, and "Capital Punishment in 1749," by Bauman L. Belden, are interesting.

—*The Monist* for January, 1891, a philosophical quarterly published by The Open Court Publishing Company, Chicago, contains "The Architecture of Theories," by Charles S. Peirce; "Illustrative Studies in Criminal Anthropology," by Professor Cesare Lombroso; "The Squaring of the Circle, the History of the Problem from the most Ancient Times to the Present Day," by Hermann Schubert; "The Criterion of Truth, a Dissertation on the Method of Verification," by Dr. Paul Carus; "Five Souls with but a Single Thought: the Psychology of the Star-Fish," by Carus Sterne; "German Philosophy in the Nineteenth Century," by Professor Friedrich Jodl; "Recent French Philosophical Works," by Lucien Arréat; book-reviews; and contents of the philosophical periodicals of America and Europe.

—"The fancy took me to go to Noto," says Mr. Percival Lowell, in his paper on "Noto: An Unexplored Corner of Japan;" and where Noto is, and how he went there, is not only the subject of the opening article in the January *Atlantic*, but is to be the subject of several articles which are to follow. Cleveland Abbe's paper, which will command attention, suggests a new university course, this course to be devoted to terrestrial physics as a distinct department of instruction. Mr. Charles Worcester Clark writes about compulsory arbitration, in which he says that one of the most striking features of our easy-going American character is ready submission to the domination of our servants, whether it be Bridget in our kitchen, the railway in our streets, or Congress in the Capitol at Washington. Professor Royce has a long paper on Hegel, Adolphe Cohn writes about Boulangism, and Mr. Henry Charles Lea indicates the lesson of the Pennsylvania election.

CALENDAR OF SOCIETIES.

Biological Society, Washington.

Dec. 27. — Cooper Curtice, A Preliminary Study of Ticks in the United States; C. Hart Merriam, Exhibition of a New Rabbit from the Snake Plains of Idaho; W. H. Dall, On the Topography of Florida with Reference to its Bearing on Fossil Faunas; F. A. Lucas, Exhibition of Young Hoatzins.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

A UNIVERSITY GRADUATE IN SCIENCE, at present a junior student in medicine at the University of Michigan, desires a position as teacher or laboratory assistant. Special preparation in Zoology, Histology, Physiology and Human Anatomy. Will also teach, if desired, Physics, Chemistry, Botany, Entomology, Embryology, Bacteriology and Sanitary Science. References and full particulars on application. H. B., 20 East Jefferson St., Ann Arbor, Mich.

WANTED.—A young man wishes a position as instructor in the sciences in some school or college. Chemistry a specialty. Would like to hear of some position with a private or manufacturing chemist, in which his knowledge of chemistry would help him. Address E. E. TOWNE, B.A., 272 Worthington St., Springfield, Mass.

WANTED.—An Exploring Expedition, backed by $15,000, will be sent into Alaska and the British Northwest Territory the coming year, to be gone one or two seasons. A scientist or two will more than likely be taken along. Applications from such will be gladly received and carefully considered. To assist in making these applications the commander would say that he considers a full practical knowledge of mineralogy and geology necessary, and if the applicant can add the duties of botanist, ethnologist, or any other of the sciences, and photography, sketching, medicine and surgery, or other useful arts for exploring, it will add to the chances of being selected. Applicants must be physically perfect, and ought to be about medium age. One of these scientists will be the second in command of the party. Any credentials forwarded for consideration will be returned, if requested, after consideration. Address "ALASKA," care of *Science*.

WANTED.—There being a considerable annual income for the purchase of books for the Museum Reference Library of Iowa College, it is desirable to have at hand any and all circulars, specimen sheets, catalogues, etc., of all works on Natural History in general, both foreign and domestic. Circulars of museum supplies, apparatus, etc., etc., desired also. State terms. Address ERWIN H. BARBOUR, Box 1333, Grinnell, Iowa.

WANTED.—A situation as Analytical Chemist is desired by the assistant of the late noted scientist, Dr. Cook, during his 15 years survey of the State of New Jersey. Highest testimonials furnished. Address Prof. EDWIN H. BOGARDUS, New Brunswick, P. O. Box 224, care Prof. F. C. Van Dyck.

COULD some one inform me what the ingredients and origin of asphalt as used for street-paving and gathered at Trinidad are? Also how gathered and shipped by natives, and mode of refining by the Warren-Scharf Co. of New York and the Barber Co. of Washington? G. KNIPER, 28 Gunn Block, Grand Rapids, Mich.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1890 Seeger and Guernsey Cyclopedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost $6. David R. Lewis, Saybrook, Ill.

For exchange—Nice specimens of Unios alatus, trigonus, parvus, occidens, anadontoides gibbosus, rectus, verucosus, gracilis coccineus, ventricasus, multiplicatus and plicatus cornutus. Margaritana confrogosa, complanata, rugosa. Anadonta edentula, decora, corpulenta, and about 300 of the beautiful Ana. suborbiculata. Wanted: Unios from all parts of the world, and sea-shells. Address Dr. W. S. Strode, Bernadotte, Ill.

SCIENCE

[Entered at the Post-Office of New York, N.Y., as Second-Class Matter.]

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

NINTH YEAR.
VOL. XVII. No. 414. NEW YORK, JANUARY 9, 1891. SINGLE COPIES, TEN CENTS. $3.50 PER YEAR, IN ADVANCE.

THE OUTLOOK FOR APPLIED ENTOMOLOGY.[1]

GENTLEMEN,— You have made it the duty of your presiding officer to give an annual address,— a duty the less easy to perform for a new organization than for one which has a history behind it, and not facilitated by my absence in Europe at the time of your organization.

I had thrown together a sort of *résumé* of the results obtained during the year in economic entomology, more particularly by the entomologists of the different State stations, in the belief that this would be one of the most appropriate themes to present; but when I learned, from his circular of Sept. 15, that Professor Forbes intended covering substantially the same ground, and that it was expected of him as one of his duties as chairman of the committee on entomology of the Association of Agricultural Colleges and Experiment Stations, it became evident that what I might present in that direction would be substantially anticipating and repeating what we may expect and hope to hear from him. I will endeavor, therefore, to touch upon a few matters unconnected with station work.

Some Results from the National Department at Washington.

The hydrocyanic-acid gas treatment against scale-insects is becoming more and more common in California, and has to a certain extent superseded the use of washes, especially against the red scale (*Aspidiotus aurantii*). This is largely due to the fact that recent experiments, carried on through Mr. Coquillett, have resulted in a great cheapening of the process. The expense has been reduced to one-third, and the bulky machinery mentioned in my report for 1887 has been for the most part dispensed with. It has also been found that the use of the process at night is safer and more beneficial, in that it lessens the effect of the gas upon the foliage.

The repeated importation of scale-insects from Florida into California has attracted much attention. The species concerned are principally the purple scale (*Mytilaspis citricola*), the long scale (*M. gloverii*), and the chaff scale (*Parlatoria pergandei*). The fact that these insects must have been repeatedly imported into the State in past years without obtaining a foothold, has been used as an argument against a quarantine, and a great deal of discussion on the subject has been had in the California papers. From my own observations in the State, I am convinced, that, where the proper conditions of shade and moisture are obtained, there is no reason why these scale-insects should not obtain a foothold, but that they will probably die out in the hotter, dryer, and less shaded localities. An agent who was sent to Pomona to investigate certain newly planted orange-groves of Florida trees found, that while the trees were planted a year previously, and had been dipped, according to custom there, in a caustic solution, every tree examined by him bore a few specimens of the purple scale. The excitement on this subject in California has been fostered by the claims of rival nurserymen engaged either in the importation of Florida stock or dealing in varieties grown at home, and with so many contrary claims from persons prejudiced by their business interests, it is difficult to extract the truth. A rigid quarantine, not absolutely prohibitive, were wisest, for great injustice might be worked by absolutely prohibitive restrictions. Careful inspection and thorough treatment, if they could be guaranteed, would prove an effective safeguard, but it were unsafe to trust to them without rigid quarantine.

I have commenced a series of experiments upon the black scale (*Lecanium oleæ*), a species which, ordinarily occurring upon the olive, has long damaged citrus fruits in California. The horticulturist of the Wisconsin station, Mr. E. S. Goff, has modified the Nixon pump by adding a tube, so that kerosene may be drawn from one receptacle and a mixture of soap and water from another, thus forming a mechanical mixture in the act of spraying. This modification, at the request of Professor Henry, I have had tried in this series of experiments, and although it is too early to state the results, it may be said that so little time and labor are required in preparing a stable emulsion, that this mechanical substitute will probably not come into general use. In this connection it may be observed that the formulæ recommended by some of our most voluminous writers are very misleading, and are calculated to produce only a mechanical mixture more or less unstable. The use of kerosene, temporarily combined with water or soap-suds by mechanical means, dates from many years back. It was a favorite remedy of my friend Thomas Meehan, who urged it in 1871 in the *Gardener's Monthly;* it was experimented with by others; and I used it successfully in 1872 against an undescribed *Lecanium* on Austrian pine, as also against *Aphides* on the place of Mr. Julius Pitman of St. Louis, and in 1874 and 1875 against the congregated young of the Rocky Mountain locust. But the true and stable kerosene emulsion which now forms one of the most satisfactory and widely used insecticides, and which requires two parts of the oil to one of the emulsifying agent, violently churned until a stable, butter-like emulsion results, was the outgrowth of my efforts in the investigation of the cotton-worm, the milk having been first suggested in 1878 by the late Dr. W. S. Barnard while working at Selma, Ala., and the most satisfactory formula in 1880, from experiments which I had continued over two years by Mr. H. G. Hubbard on orange-trees.

A locust outbreak of some interest has occurred in parts of Idaho and Utah, and has been investigated by Mr. Bruner,

[1] Address of Dr. C. V. Riley at the annual meeting of the Association of Economic Entomologists, Champaign, Ill., Nov. 11-14, 1890.

the Nebraska agent of the division. The species involved proved to be *Camnula pellucida*, which has overrun a strip of country a hundred and forty miles in length by from fifteen to thirty in width, commencing at a point about thirty miles westward of Soldier, Idaho, and extending east as far as East River and Birch Creek. The people in these sections are quite willing to do whatever can be done to destroy these insects, but they need instruction. The country has been largely settled since the publication of the early reports of the United States Entomological Commission, and the new settlers lack experience in dealing with locusts; for fifteen years make great changes in the rapidly growing West. I have therefore in preparation a bulletin treating of the several species of locusts which are responsible for these frequent scares, and which will include, at the same time, a summary of the practical portions of the earlier reports of the Entomological Commission on *Caloptenus spretus*, long since out of print.

The army-worm proved injurious in several localities during the past year, particularly in Maryland and Indiana. The Maryland occurrence is of considerable interest, owing to the fact that the preceding year was one of unusual precipitation; and the outbreak of the insect was due rather to the extremely mild winter, which prompted the constant growth and development of the hibernating larvæ

The notices in *Insect Life* and the *Entomologists' Monthly Magazine* of the damage caused by a new bark-louse to the gardens of Alexandria, Egypt, have attracted considerable attention, and Mr. J. W. Douglas has described the new depredator as *Crossotosoma ægyptiacum*. A study of Mr. Douglas's description and figures has convinced me that this insect is an *Icerya*. and that its spread is greatly to be feared, judging from our experience with *I. purchasi*. Moreover, three additional species of this genus have been brought to my notice during the year,— one occurring in Mexico on grape-vine; another in Key West, Fla., upon roses and other garden plants; and the third in the Island of Montserrat, West Indies, upon the cocoa palm, the banana, and a species of *Chrysophyllum*. These interesting and injurious insects have been investigated, so far as could be done, by correspondence; and full descriptions, with figures, will be published in the forthcoming number of *Insect Life*.

The sugar-beet industry, after a quarter of a century's vicissitude, has begun a substantial and permanent growth, especially in Nebraska. It has been found that the crop is speedily attacked by insects; and Mr. Bruner, being advantageously located for work of this kind, has, during the past summer, paid some attention to the insect enemies of this crop, and has already a list of sixty-four species, most of them being leaf-eaters and such as are commonly found upon various allied succulent plants, one of the worst being the garden web-worm (*Eurycreon rantalis*).

The Hop Phorodon.

One of the most interesting facts of the year has been the occurrence of the hop-fly (*Phorodon humuli*) in the extreme North-west, especially in Oregon and Washington, so soon after my note of warning as to the danger of its introduction to the hop-fields of that section, and the need of precautionary measures that might prevent such a calamity. The soil and climate of southern Oregon seem particularly adapted to the growth of the hop, as it is already the leading crop in Lane, Marion, Polk, and other counties.

There can be no doubt about the species, because Mr. F. L. Washburn, the entomologist of the experiment station, has given it some attention; and I have also received specimens from him and from Mr. A. Todd of Eugene, Oregon, as also from Mr. Giles Farmin and Mr. G. M. Stratton of Puyallup, Wash.

Mr. Washburn, from the fact that it has been noticed that hops were sometimes not so much affected in the immediate vicinity of plum-trees as some distance away, and from the further fact that some of the growers reported that they never saw the insect on the plum, intimates that there must be a different state of affairs in Oregon, so far as the life cycle of the insect is concerned, from that which prevails in the Eastern States and in Europe. Absolute and experimental proof of facts obtained after long and persistent investigation should never be lightly questioned. It is by no means a common experience that hop-plants in the immediate vicinity of plum-trees are not more affected than, or as much as, others at a distance; and this may depend on the direction of the wind, or on local circumstances, or on the variety of plum, whether wild or cultivated. I have examined in vain certain cultivated plum-trees for evidence of *Phorodon*, whereas I have invariably found it upon other varieties in the same vicinity. *Phorodon humuli*, in common with all other aphidids, preferably chooses, when migrating, certain genial days, and often fills the air, flying great distances. In perfectly calm weather the migrants settle almost everywhere; but they are easily affected by the least breeze, and are wafted in different directions. The invasion of a hop-yard may be from plum-trees miles away to windward.

Phylloxera.

The grape *Phylloxera* has continued to attract the attention not only of most European governments, but also of those of Australia and New Zealand. It continues its spread in France, having at last invaded the more valuable champagne districts. The last report of the Superior Phylloxera Commission of that country shows that about 240,000 acres have undergone defensive measures, submersion being employed in 72,000, bisulphide of carbon in 145,000, and sulpho carbonate of potassium in 23,000. The work is practically at an end in such departments as Hérault, Gard, and Gironde, where the American resistant vines have most effectually been used; while the wine-growers of Algeria, Spain, Italy, Portugal, Hungary, Austria, and Switzerland, are all battling against it, and are all more or less aided by their respective governments.

The advent of the insect in New Zealand has been the cause of much writing and of much legislation there, and the government has been quite anxious to get the best and latest information on the subject There is very little that is available in the way of published experience in this country, as my Missouri reports are now very difficult to obtain. I would repeat here in substance what I have recently written to Mr. F. D. Bell, agent general at London for New Zealand, because the demand for the information is continuous, and our own people are to a great extent unfamiliar with the facts.

During the more than twenty years' struggle in France against the species, innumerable remedies have been proposed, most of which have proved to be absolutely valueless. A few measures have been devised, however, which, under proper conditions, give fairly satisfactory results. These consist in (1) methods which avoid the necessity of direct treatment, comprising the use of American stocks and planting in sandy soils; (2) the employment of insecticides (bisulphide of carbon, sulpho-carbonate of potassium, and the kerosene emulsion); and (3) submersion.

It was early found in the history of this *Phylloxera* that most of the cultivated varieties of American grape-vines, as also the wild species, resisted or were little subject to the attacks of the root form (*radicicola*) of the *Phylloxera;* although the leaf-gall form (*gallicola*), which in point of fact does little if any permanent damage, occurs in greater numbers on many of our wild and cultivated sorts than on the European grape-vines, which are all derived from the single species *Vitis vinifera*, and which are so exceedingly subject to the attacks of the root form. This fact was first noticed in France by M. Laliman of Bordeaux, and later by Gaston Bazille of Montpellier, and was independently proved on a more extended scale by my earlier investigations in the United States. The use of American stocks upon which to cultivate the susceptible European varieties has resulted in an enormous trade in certain American seeds and cuttings, and now supersedes all other methods against the *Phylloxera*.

It was my privilege and pleasure to spend a week in August, 1889, among the world-renowned Médoc and Sauterne vineyards of the Bordeaux district in France. Here, by virtue of the rich alluvial soil, and the ease with which the chief vineyards can be submerged, the *Phylloxera* has made slower headway, and the opposition to the use of American resistant stocks has been greatest. Yet they have finally vanquished prejudice, and are, either from necessity or choice, rapidly coming into general use. When I say "choice," I mean that even where the French vines yet do well, and the *Phylloxera* is kept in subjection by other means, it is found that greater vigor of growth and increase in healthfulness and yield of fruit result at once from the use of the American stocks.

Without going into a lengthy discussion of the subject of wild American species, those of practical importance to the grape-grower are the following: *V. æstivalis*, *V. riparia*, and *V. labrusca*.

The varieties derived from *V. æstivalis* are of value for their fruit as well as for their resistant qualities, and, being easily propagated from cuttings, they are very often used as stocks. The most important varieties are Jacquez, Herbemont, Black July, and Cunningham.

The varieties of *Vitis riparia*, both wild and cultivated, are, on account of their special fitness, almost exclusively employed in France as resistant stocks, for which they easily take first rank. The varieties used are (1) the wild forms; and (2) the cultivated varieties, Solonis, Clinton, and Taylor. Of the cultivated varieties, the Clinton was one of the first vines tried for this purpose, and has been extensively used with fair satisfaction. The Solonis now ranks above it, but is valueless for any other purpose on account of the acidity of its grapes. In California the Lenoir, Herbemont, and Elvira have been used, but late experience shows that the wild *Riparia* is most satisfactory there, as it is in France.

The different varieties of *Vitis labrusca* are less resistant to the *Phylloxera* than those above mentioned. Certain varieties have, however, been grown successfully in France, and of these the Concord has given much the best results; but others, Isabella and Catawba for example, succumb there to the root-louse, as indeed they do in many sections of this country.

Of the many valuable hybrids obtained from the American species of *Vitis* which are serviceable as stocks, the more important are the Elvira, Noah, and Vialla. The last named, perhaps, of all the resistant varieties, gives the greatest percentage of successful grafts, and is admirably adapted for grafting on cuttings.

Early in the study of the subject it was found that the nature of the soil has a very marked influence on the success of the different stocks. The subject has been now quite fully investigated in France, and the latest researches are formulated by the Experimental School at Montpellier in the statement quoted below, which will be of interest as giving the various classes of soils, together with the American vines best adapted to each.

"1. New deep fertile soils: *Riparia* (tomentous and glabrous), *Jacquez*, *Solonis*, *Vialla*, *Taylor*, and *Cunningham*.

"2. Deep soils somewhat strong, not wet: *Jacquez*, *Riparia*, *Solonis*, *Cunningham*, *Vialla*, *Taylor*.

"3. Deep soils of medium consistency, new and not dry in summer: *Riparia*, *Jacquez*, *Solonis*, *Vialla*, *Taylor*, *Black July*.

"4. Light pebbly soils, deep, well drained, and not too dry in summer: *Jacquez*, *Riparia* (wild), *Taylor*, *Rupestris*.

"5. Calcareous soils, with subsoil shallow or granitic: *Solonis*, *Rupestris*.

"6. Argillaceous soils, white or gray: *Cunningham*.

"7. Argillaceous soils, deep and very wet: *V. cinerea*.

"8. Deep sandy fertile soils: *Riparia* (wild), *Solonis*, *Jacquez*, *Cunningham*, *Black July*, *Rupestris*.

"9. Light pebbly soils, dry and barren: *Rupestris*, *York*, *Madeira*, *Riparia* (wild).

"10. Deep soils with a tufa base and salt lands: *Solonis*.

"11. Soils formed of *débris* of tufa, but sufficiently deep: *Taylor*.

"12. Ferruginous soils, containing red pebbles of silica, deep and somewhat strong, well drained but fresh in summer: all the varieties indicated, and in addition *Herbemont*, *Clinton*, *Cynthiana*, *Marion*, *Concord*, *Herman*."

The accompanying table from the last report of the Superior Phylloxera Commission indicates better than words can tell the steady growth in the use of the American vines: —

Years.	American Vines Covered. Acres.	Departments.
1881	22,000	17
1882	42,700	22
1883	70,000	28
1884	131,909	34
1885	188,200	34
1886	276,900	37
1887	418,700	38
1888	536,900	43
1889	719,500	44

On the subject of direct remedies the value of the kerosene emulsion for this purpose has not been properly realized in France because of the relatively high price of petroleum in her grape-growing *départements*. A series of experiments which I made in 1883 showed conclusively its great value for this purpose, as it not only destroys the insect in all stages, but also stimulates root-growth.

In this connection I have recently had a series of experiments made through Mr. Albert Koebele's agency, in the Sonoma valley, California, to ascertain the effect upon the *Phylloxera* of certain of the resin-washes which proved so

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

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CONTENTS:

THE MINERAL WATERS OF THE YELLOWSTONE NATIONAL PARK.

The recent publication of Bulletin No. 47, of the United States Geological Survey, containing analyses of hot-spring, geyser, and river waters from the Yellowstone National Park, is not without interest to the medical profession and to the public at large.

The waters, collected by experts employed by the Geological Survey, have been most carefully examined by Dr. F. A. Gooch, now professor of chemistry at Yale College, and Mr. J. Edward Whitfield of the survey laboratory, and represent the latest and best methods of water-analysis.

The analyses of these waters are of particular interest, because the great variety of mineral springs found in the Yellowstone, attracting the attention of all visitors to that region, suggests their use as remedial agents in the cure of disease.

Aside from the well-known resorts of the Virginias, there are but few places in the United States where natural hot waters are thus utilized. The hot-springs of Arkansas have long been known, and many cures effected by their use, combined with the care of the attendant physicians. More recently the Spas of Las Végas, N. Mex., have been brought before the notice of the medical profession and the public generally.

Without detracting from the merits of these justly noted sanitaria, it may be stated that at neither place do the waters present as important a combination of salts in solution as those of the Yellowstone Park. Indeed, with the exception of the hot-springs in New Zealand, no waters readily accessible are known presenting the variety and remedial constituents of the Yellowstone springs. In New Zealand the government, appreciating the munificent endowment which nature has given the country in its hot-springs, has set apart certain tracts as sanitary resorts; and at the most famous resort, Rotorua, bath-houses and bathing-pools, with the usual accessories of reading-rooms and hotels, have been built at government expense, and are under the supervision of a government physician.

From a therapeutic standpoint, the analyses of hot-spring waters from the Yellowstone may be grouped as calcareous, alkaline-silicious, acid, and sulphurous.

The former, comprising the hot water of the Mammoth Hot Spring, are highly charged with carbonate of lime, which they deposit, on exposure, in the form of travertine. They resemble in composition the waters of Carlsbad, as will be seen by a comparison of the analyses of the two waters.

For bathing purposes they are less agreeable, and probably less beneficial, than the alkaline waters of the geyser basins of the Yellowstone Park.

These latter waters are generally highly charged with alkaline salts, — sodium chloride and sodium carbonate, together with silica, being the chief constituents, — but there is generally present also a small amount of sodium borate, also sodium arseniate, the latter a most valuable therapeutic agent in a variety of diseases.

The luxury of bathing in these waters must be indulged in to be appreciated. The extreme softness of the water, and the delightful freshness which one notices after the bath, render the use of the water a great pleasure. In New Zealand, where a water almost identical in composition, save that it lacks the arsenic, has been used for several years, this type of water has been found most beneficial in the treatment of gout, rheumatic troubles, and sciatica. In France the curative properties of waters carrying arsenic in solution are fully recognized, especially for the cure of certain forms of nervous and skin diseases. While the Yellowstone waters contain a little less arsenic than those of the French springs at La Bourboule, there is no reason to doubt their usefulness for similar diseases. At present the only water of this class utilized for bathing purposes is that of the Hygeia Spring, supplying the baths of the hotel at the Firehole, or Lower Geyser Basin.

This water carries three-tenths of a grain of sodium arsenic to the gallon. It has been tried by the writer, and found a most delightful water for bathing, but no invalids have yet tested its virtues. Springs of this character are, however, very numerous, and their waters might be easily utilized for bathing.

The acid waters, carrying free hydrochloric acid, are less numerous in the park, but many springs of this character are found at the Norris Geyser Basin. The waters may be perfectly clear, as is the case with the outflow of the Echenis Geyser and the discharge from Green Spring, or turbid, and charged with more or less sulphur, as is more frequently the case. Such waters have achieved a considerable reputation in New Zealand as a tonic and alterative, particularly in diseases of the liver and in functional troubles of females.

They also exert a powerful effect upon the body in all skin-diseases, but are probably less useful than the sulphurous waters in such cases. At present no waters of this character are utilized for baths, but could be readily led into suitable bath-houses at the Norris Basin. This locality is indeed the best suited for a sanitarium of any of the geyser basins of the park, as all the varieties of waters occur here, save the calcareous.

Sulphurous waters are very familiar, though those of the Yellowstone are particularly strong. The Mammoth Hot Spring waters, though smelling strongly of sulphur at the vent, possess little, if any, of that important constituent when led into baths, for it is all deposited about the vents and upon the algæ growing in the waters; but excellent examples of this type are found at the Norris Basin, as well as elsewhere in the park.

Now that the roads and hotel accommodations in the park are so good, and the region so easily reached in Pullman coaches and with dining-cars, it is to be hoped that the waters of these springs may bring relief to many sufferers.

WALTER HARVEY WEED.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Time-Measuring among Savage Peoples.

THE question has arisen in the National Museum whether the American aborigines or any other savage peoples have any mechanical devices for measuring the time of day or portions of the day. I do not now allude to calendars, of which there are many, nor to observation of dawn, sunrise, a little after sunrise, near noon, noon, etc., based on the diurnal movement of the heavenly bodies, but to primitive dials and the like. I have heard of the Montaguai's practice of setting a staff in the snow and marking the shadow, and of the Pueblo habit of marking the path of a sun-ray across the floor, but my information is not first-rate. My familiarity with the African and Insular peoples is limited; but it is designed to set up in the National Museum an elaborative series to illustrate time-keeping, and we are anxious to know what manner of invention should stand at the beginning of the series.

OTIS T. MASON.

Washington, Jan. 10.

Professor Ferrel and American Meteorologists.

IT would seem to be high time that some one having authority should read the riot act to a number of American meteorologists. The views lately advanced by Dr. Hann, that cyclones (excepting those of tropical regions) have their origin rather in the great general movements of the upper atmosphere than in the ascensional movement of relatively warm and moist air and the consequent vapor condensation, may or may not stand the test of a more extensive and critical series of temperature studies than those made in 1889, but it is none the less incumbent upon American meteorologists to treat with proper courtesy the conscientious and life-long labors of a fellow-countryman; and it is but scant courtesy to exhibit to the world an eagerness to drag into prominence and accept seriously a new theory of cyclonic genesis, when such a theory lacks in every way extensive and careful study, and is really but little more than a mere possibility suggested by an eminent foreign meteorologist, when he found in certain temperature observations a somewhat marked difference from those which the accepted theory seemed to him to require.

There may be "thermic," and there may be dynamic, cyclones; but the observations should be numerous and trustworthy before it is claimed that such a distinction exists, and before we seriously accept the very radical view that temperatures in cyclones are determined by the motions of the air. A thorough series of temperature determinations at different parts of the storm, as a mechanism, is needed, and should be offered. Especially is this demanded when the acceptance of the new view implies a partial remodelling, at least, of a theory that is of long standing, and has the sanction of one of the best equipped minds of the many that have tackled meteorological problems. Should occasion require, Professor Ferrel can doubtless successfully defend the views he holds; but, for the benefit of some who may not be aware of his methods of work, it may be not out of place to say here that nothing from his hand is the result of haste, but, on the contrary, the result of mature thought, and patient, careful, deliberate study of the best scientific information at his command.

With all possible deference to Dr. Hann's eminence in matters meteorological, it is to be questioned whether a series of temperature observations at some fourteen stations, seven of which have an altitude of over two thousand metres, for only two storms (the barometric maximum of Nov. 12–24, and the minimum of Oct. 1), prove any thing, after all, but that it is quite possible to find temperatures higher than the normal when lower ones might be expected. But this abnormality is but a slim support for a new theory, nor does it disprove the old. The air in the high area late in November was apparently warmer than the air in the "low" at the beginning of October; but that does not prove that the mean temperature of the air in any and every maxima is always higher than the mean temperature of any and every extra-tropical minima (it is conceded that the new theory will not hold for tropical storms). Dr. Hann claims that seven of these alpine stations have an elevation over two kilometres above sea-level. Yet it may be an open question if these heights give the conditions which he sought, more particularly if we remember that certain of the cirri clouds certainly have an elevation of not less than eighty kilometres, and a two-kilometre temperature observation may give but an uncertain indication. We can even find at surface stations abnormalities, that, if misinterpreted, might lead us to doubt a great many of our accepted views in the matter of atmospheric temperature. Mr. Kingston,[1] director of the Toronto Observatory in 1868, called attention to the fact that the twelve-year normals (1841–52) were not applicable to observations of later years, and, according to five-year normals, it was easy to show that January was warmer than February, etc.; and Schott shows in a table how, from 1841 to 1850, February was colder than January at New Haven, Toronto, Philadelphia, Charleston, and Savannah, while from 1851 to 1860 the reverse holds true.

It is therefore, it seems to me, only fair to insist that American meteorologists demand full and most thorough evidence before seriously considering the question of modifying present theories; more particularly, too, when an unintentional but none the less real disposition exists in certain quarters to speak carelessly of Professor Ferrel and his work, and to deny him his proper place.

Not a bad example of this carelessness appears in a translation by E. F. Bamber, in the *Philosophical Magazine* for December, 1890, of Werner von Siemens's views on a general system of winds of the earth. The eminent physicist, in refuting the statement of Dr. Sprung in a recent paper in the *Meteorologische Zeitschrift*, that he attempted, like Ferrel, to found on theoretical calculations a theory of the general system of winds on the earth, disclaims in all modesty a sufficient proficiency in the higher mathematics to do this, but then immediately adds, it appears to us somewhat illogically, that he "considers this method altogether inappropriate." He therefore repudiates the charge that "he sought, like Ferrel, to demonstrate by means of calculation an original state of atmospheric motion in order to afterwards base his further speculations thereon."[2] There is no intentional intimation here, we take it, that Ferrel's views are based on a supposition more or less hasty and uncertain, and there is therefore little occasion for the rejoinder that any such intimation indicates a lack of familiarity with Ferrel's work; but it ought to be felt and recognized, especially by American meteorologists, that experimental fact rests at the bottom of every natural law

[1] See Schott's Tables, p. 199.

[2] Sitzungsberichte d. K. Preuss. Akad. d. Wiss. zu Berlin, 1890.

discussed by Ferrel, that in every case the latest and most accurately determined physical constants are used, and that the theoretical deductions, while simply offered as such to be tested, are strictly the results of mathematical analyses. If in time these appear inadequate, the measure of praise for the man and his work may be diminished, but only in proportion as it is remembered that meteorological data and laws were in a condition more or less chaotic when he took up his labor of developing these into a consistent harmonious science.

ALEXANDER MCADIE.

Washington, D.C., Jan. 9.

Cyclones and Areas of High Pressure.

I HAD supposed that Professor Davis would give some explanation of the argument against the condensation theory of cyclones deduced from the comparisons of the temperatures in cyclones with those in high-pressure areas. He commences with a citation from my book, in which I state that the high pressures in the north-west sides of cyclones in the higher latitudes in winter are caused mostly by their lower temperatures, and consequently greater densities. He thinks the high pressure over the Alps in November, 1889, is a typical case of all such high-pressure areas. While I do not so regard it, yet, for the sake of brevity, I will here concede it, and consider merely this supposed typical case. Over the Alps, during the last five of the fourteen days of the existence of this high pressure, the temperature on the summits of the Alps was found to be several degrees warmer than the normal temperature of the season. There are no observations to show how high this abnormal temperature extended, but I am willing to admit that it may have extended up to a considerable altitude. Professor Davis, because this temperature is found to be above the normal a few degrees, maintains that the descent of the air is not due to its being heavier than the surrounding air, thus assuming that the surrounding temperatures at a distance at the time are the same as the normal temperature, notwithstanding the well-known great and long-continued departures from the normals which frequently occur over large areas of the country. But it is not necessary that this body of heated air in high-pressure areas should have a temperature lower than the surrounding temperatures even; for if the great vertical extent of air above it has a temperature only one or two degrees lower than the surrounding temperatures on the same levels, which gives rise to a descending current, the air below, if it even has a little higher temperature than the surroundings, cannot rise up through the descending current, but must be forced downward. But suppose it were clearly established that the air in a high-pressure area extending hundreds of miles had a lower temperature than the surroundings even, and not merely the normal of the season: how is the greater pressure and the descent of the air to be accounted for? Professor Davis has never hinted at a probable explanation merely. The deduction, therefore, from a few surface observations merely in a very limited region, that the air over a large area, and extending to the top of the atmosphere, is warmer than the surrounding air at a great distance in all directions, especially where these few observations are found to give a temperature above the normal merely, and not above the surrounding temperatures at the same levels, should be received with great caution; for, if there were even a well-established theory to account for the descent of the air under these circumstances, these observations could scarcely be regarded as having any weight in confirmation of such a theory.

In what precedes I have gone upon the assumption that a lower temperature is the only cause of the descent of the air in high-pressure areas. While I regard this as adequate to account for it, I have never said or thought that it is the only cause, but simply the principal cause. I think there are other causes, especially in the origin of these high-pressure areas, which, for our present purpose, it is not necessary to discuss here.

Professor Davis says, "Records of temperature made on high mountain-peaks furnish the best means of testing the convectional theory of cyclones, for, even if all other tests were successfully borne, failure under this test would be fatal to the theory." By "convectional theory of cyclones" I understand him to mean the condensation theory, which requires the air in the ascending current to be warmer and lighter than that of the surroundings at the same levels. Now, this theory can neither be established nor overthrown by any such tests. Cyclones are usually several hundred, sometimes a thousand and more, miles in diameter; and to prove that the air over so large an area up to the top of the atmosphere, or at least up to high altitudes, has a higher or a lower temperature than its surroundings, would require numerous stations of observation at many different levels, not only over this large area, but also all around this area at great distances. The condensation theory requires that the temperature of the air in a cyclone must be greater, in a general way, than that of the surrounding air; but this does not mean that there are no places within the cyclone, especially on the earth's surface, with lower temperatures than those of many places outside. In the theoretical treatment of a cyclone we have necessarily to assume certain regular conditions of uniform temperature at the same distances in all directions; but I have always been careful to explain that such conditions are never found in nature, but generally only rough approximations. In a large cyclone there is a great difference between the north and south sides, due to difference of latitude, which is taken into account in the general motions of the atmosphere, and so must be excluded in the treatment of the cyclones, and the differences of temperature only with reference to corresponding temperatures outside of the cyclone on the same latitudes must be considered. Besides, the temperatures vary all around the cyclone, not only on account of difference of latitude, but likewise from various abnormal causes. It must be expected, therefore, in comparing inside temperatures with the surrounding ones, especially surface temperatures, that there would be numerous cases in which those within would be found lower than many of those in the surroundings. The theory only requires that there shall be a predominance of higher temperatures in the interior. Besides, the conditions of a cyclone need not extend down to the surface at all, and, in fact, mere surface conditions generally have little or nothing to do with a cyclone. If the necessary conditions exist at altitudes only considerably above the earth's surface, the air is thrown into a great whirl or gyration, which relieves the air below of a part of the pressure upon it, and increases the pressure round about; so that this air tends to rise up, just as the water does in a suction-pump, and the surrounding air flows in to take its place; and in flowing in it assumes a gyratory motion, not only from the deflecting force of the earth's rotation, but likewise from the action of the air above by means of friction, so that it is brought into the general vertical and gyratory circulation. But suppose that it could be shown that the air in a cyclone is mostly or entirely of a lower temperature than the surrounding air at all altitudes, and yet ascends, as it always does: how is this strange phenomenon to be accounted for when there is no force, either real or imaginary, to cause it to ascend?

Professor Davis thinks that the snow-fall on the Alps at the time of the cyclone of Oct. 1, 1889, had little effect in lowering the temperature, on account of the wind; but this is one of the causes which Dr. Hann gave, a few years ago, of the lower surface temperatures in cyclones. The air, in being forced up the mountains on the windward side, is expanded and cooled below the temperature of the air generally on the same level. Another reason which he assigned was, that as the lowest pressure above lags behind that below, as was shown by Loomis, and first explained, I think, by Dr. Hann, the cold north-westerly winds set in above rather before the lowest pressure-point is passed. The real centre of the cyclone above is not that of lowest pressure.

I admit that it is not strictly logical to assume that two theories, or two kinds of forces, may not be such as to give the same effects, especially where nothing is known of the nature or manner of application of the one kind; but still this is extremely improbable. As the general motions of the atmosphere, cyclones, and tornadoes, are all very much alike, consisting of gyrations around a centre,— and it is admitted that in the first and last the air rises where it is warmest and lightest and because this is so, and that this is even the case with cyclones in the lower latitudes,— we should hesitate in making an exception in the case

of cyclones in the higher latitudes, because a few surface observations merely of temperature, which, as has been shown, I think, should have no weight, seem to indicate that the complete conditions of a cyclone, upon the condensation theory, do not exist.

Mr. Clayton, in his communication, sets out in a very commendable way by discarding mere authority in scientific questions. He, however, proceeds to give two columns of citations from different authorities. But the most of this is entirely proper; for we have to depend more or less upon authority for observational data, and it is only where the decision of a question depends merely upon the use and application of scientific principles that mere authority should be discarded. All observations, however, should be well considered and weighed, especially where they seem to conflict with well-established scientific principles. I have been familiar with all of Loomis's meteorological papers, and I do not call to mind any cases in which his results deduced directly from observation seemed to be in conflict with any theories which I have advocated, but of course there are some things which I cannot satisfactorily explain. I have always made numerous quotations from Loomis's papers in confirmation of my theories It is a little singular, however, that Mr. Clayton should cite some of the same things against me. From some of Loomis's theoretical deductions from the observations I dissent.

With regard to the comparisons of observations at Denver and Pike's Peak, both merely surface observations at a long distance apart, in order to show whether the air is in a state of stable or unstable equilibrium over an area hundreds of miles in diameter, it is not necessary for me to add any thing more to what I have already stated on that subject. These cases were mostly in the summer season, when mountain-peaks are cooler than the surrounding air at a distance, and when lowland stations are abnormally heated, and the vertical temperature gradient, for some distance from the surface, large. If the lower temperatures had been taken a little above the surface, and compared with one vertically above it, no unstable state, probably, would have been indicated when, as is stated, no extraordinary disturbances occurred. The reason why most of these cases of unstable, and approximately unstable, states occurred in May, I have explained in my book. Whether heated dry air has much ascensional force depends upon the state of the air. In the stable state it can only ascend until it becomes cooled down to the temperature of the surrounding air at a distance on the same levels. In the unstable state, the higher it ascends, the warmer it becomes relatively to the surrounding air; and so, of course, it rushes up with great violence until the stable state is again restored.

The fact which Loomis has established, and which is a matter of common observation, that very heavy rains do not continue very long, is very reasonable; for the more rapidly the store of energy in the uncondensed vapor is spent, the sooner, of course, must the store of energy become exhausted.

I have been at great pains to show that the unstable state, which gives rise to cyclones and tornadoes, may be induced in perfectly dry air; and I have cited Loomis in conformation of this, when he shows that cyclones of moderate barometric depression in the centre, and without any violence, do exist. But Mr. Clayton brings in the same thing against the condensation theory, under the impression, I suppose, that, because I call the theory of cyclones the condensation theory in deference to Espy, I consider vapor and its condensation entirely indispensable. The vapor is a very essential part, and without it cyclones would, no doubt, be of much less frequent occurrence, and would have little violence. Loomis has shown that when there are cyclones in dry weather, with little or no rain, the depressions are small. These take place mostly in the summer season, when the air over a large area becomes much heated; and although the ascent of air over this region is not sufficient to give rise to much rain, or even cloudiness perhaps, yet it is sufficient to cause haziness in the atmosphere, in which state the heat energy is absorbed directly from the sun's rays, instead of getting it indirectly from condensation after it has been absorbed in evaporation. Mr. Clayton cites a number of authorities to show that there is a body of warm air, a little above the earth's surface, in areas of high pressure, and that the vertical temperature gradient here is small, much less often than in cyclones. I have never denied this. It is simply storming a camp in which I am not to be found. More than six years ago, in "Recent Advances in Meteorology," I gave seven cases of this sort, one in which detailed observations were given to show that the vertical temperature gradient may become inverted. The same is given in my recent work.

Mr. Clayton thinks that Dr. Hann's recent investigations of cyclones in the Alps should add a link to the chain of evidence that the temperature of the air-column as a whole is lower in cyclones than in the surrounding air; but, if this is even admitted, where are the other links? So far as I can see, they all seem to be "missing links." He also gives his views with regard to various other things, which is well enough if they are not intended as arguments, and they do not seem to be. But still it is of much more importance to know what he can prove and establish than to know what he thinks. He thinks that mechanical action has much to do with the origin of storms; but what this means, I am unable to say. The mere origin of a cyclone, although of importance, is of little importance in comparison with the great question of where the energy comes from to support the cyclone after it has been originated.

Finally, Mr. Clayton proposes three questions for my answer. To the first and second I answer emphatically, "No." If Mr. Clayton thinks that a cyclone can originate and be maintained in this way, let him show in what way. But let him remember that he is not to commence with his high areas and his troughs, for this is not a normal condition of the atmosphere, but let him first account for these, and then proceed to show how the air in flowing into his trough is thrown into a gyration; and as the air in this area of gyration, according to the new theory, is heavier than the surrounding air, and at the same time rises up, let him especially show where the energy comes from to support the gyration and force up the heavier air in the interior. I do not say that in such a case there would not be a certain very small amount of gyratory movement produced by the flowing of the air into the trough while it was being filled up, as it would be at once if there were no restraining force to keep the air from the high pressures on each side from rushing in. But such high-pressure areas continue often a long time, and do not fill up the troughs; and the question is, what maintains them? I have fully explained all this at various times upon my principles, and I now leave it to him to explain upon his. I commence with a normal state of air without high-pressure areas and troughs of low pressure, and show how the unstable state is induced, how from this the cyclone originates, and how the gyrations cause a wave of high pressure all around, and, where there are two cyclones, how the ridge of high pressure between is caused. The low-pressure between two cyclones, together with other irregularities of pressure, permanent or otherwise, in some rare cases, gives a very oblong low-pressure area, or trough. Mr. Clayton proceeds in the reverse order, and commences with the high pressures without first accounting for them, which he makes a basis of his whole process. The world is supported upon the shoulders of Atlas, and Atlas upon the back of a tortoise; but the question still arises, upon what does the tortoise stand? Let Mr. Clayton first show upon what his tortoise stands.

With regard to Mr. Clayton's last question, I know nothing with regard to the circumstances of the cyclone to which he refers. It was in the winter, when surface temperatures are very low, and vertical temperature gradients small, and even reversed sometimes near the earth's surface. This, however, does not affect the gradient, estimated from a little distance above the earth; but I have said so much with regard to the inadequacy of a few surface observations at the bottom of the great ocean of atmosphere to prove that the air, or no part of it above, is not warmer than the surrounding air, all of which is just as pertinent in this case, that certainly nothing more can be required. As I have said before, the mere surface condition may have little or nothing to do with a cyclone. But suppose I cannot explain it, as Mr. Clayton seems to think, "upon the assumption of a higher mean temperature of the air-column within the field of the cyclone:" how does he explain it upon the assumption of a lower mean temperature and heavier air-column? He proposes his question with an

air which would indicate that he had completely explained the phenomenon upon his theory, whereas there has never been even an attempt made to explain any thing by it.

The law of gravitation, suggested by the fall of an apple, was withheld by Newton for a number of years, because, on account of incorrect data, it was not confirmed by observation. With the reserve and caution characteristic of a true philosopher, he thought it should be fully tried and tested first. But now we have a theory thrust upon us for our assent which has not been developed, and applied in the explanation of a single phenomenon in the local disturbances of the atmosphere; and yet I am censured for thinking that there has been entirely too much haste in the matter, and that it should first have been shown that it will at least account for a few of the observed atmospheric phenomena. Let the advocates of this theory, if it can be so called, take up the matter now, and show that it accounts for the phenomena as well as, or better than, the condensation theory. Let them give me a chance to look into the workings of this new theory. WM. FERREL.

Martinsburg, W. Va., Jan. 10.

BOOK-REVIEWS.

Tycho Brahe: a Picture of Scientific Life and Work in the Sixteenth Century. By J. L. E. DREYER. Edinburgh, Adam & Charles Black. 8°. (New York, Macmillan, $3.50.)

THIS is a work of much value to students of the history of science. Tycho Brahe holds a prominent place in the annals of astronomy; and he was, moreover, a member of the Danish nobility and a man of considerable means, with a wide circle of acquaintances and many opportunities for travel. Hence his life was more dramatic and fuller of incident than the lives of scientific men usually are; and Professor Dreyer has here related it in an interesting way. The book is well written, with great care in collecting and sifting the facts, and with an evident desire to be just to all parties. The early life and studies of Tycho are described somewhat briefly; but a full account is given of his early attempts at astronomical observation and of the endowments given him by King Frederick II. to enable him to pursue his chosen work. The Island of Hveen, which was assigned him to hold during the king's pleasure, became the scene of his most important discoveries; and the income it afforded, together with certain other revenues placed at his disposal by his royal friend and patron, enabled him to hire assistants and to prosecute his work vigorously for many years. But after the death of Frederick the authorities were less favorable to Tycho; so that at last his endowments were taken from him, and he left Denmark for a new field of labor under the German emperor at Prague. Professor Dreyer gives a very good description of the Island of Hveen, and the facilities available there for astronomical work, and then endeavors to explain how and why Tycho Brahe lost his position there, — a misfortune due quite as much to Tycho's own faults as to the disfavor of the authorities. His new station at Prague is also well described; and one of the most interesting passages in the book is that relating the meeting of the veteran Tycho with the young Kepler, an event of such significance in the development of science. Indeed, this meeting was the most important result of Tycho's residence at Prague, which was soon terminated by his death in his fifty-fifth year.

Of Tycho Brahe's scientific achievements, Professor Dreyer gives a full and detailed account. He was an observer rather than a thinker, and his biographer thinks that his observations could hardly have been surpassed in accuracy but for the invention of the telescope. The instruments he employed, many of which were devised by him, are described with some minuteness, and the importance of his observations as a basis for the theories of Kepler and Newton is clearly shown. Tycho's most important labors, in Professor Dreyer's opinion, were those relating to the

movements of the moon and the planets, his catalogue of a thousand stars, and his observations of comets, which were the means of refuting Aristotle's opinion that these bodies belonged to our atmosphere. Considerable space is devoted to Tycho's work in astrology, to which he gave much attention, and in which his faith, though not as enthusiastic as that of some men, was never abandoned. Altogether, Professor Dreyer's work is worthy of its theme, and will hold an honorable place among biographies of scientific men.

Introduction to the Study of Federal Government. By ALBERT BUSHNELL HART. (Harvard Historical Monographs, No. 2). Boston, Ginn. 8°. $1 net.

WE noticed the first of these monographs a short time since, and we are now glad to receive the second. It is only an introductory work, forming a pamphlet of two hundred pages, and the author tells us in his preface that it is to be followed in due time by an extended treatise on the same subject; yet it is of real value in itself. Professor Hart opens his work with a discussion of the nature of federation and of the various types of federal government that are known in history, — a discussion that shows a clear view of the questions involved, and considerable power of philosophic thought. He next proceeds to a brief but very clear account of the ancient and mediæval confederations from the first conception of the federal idea among the Greeks to the Holy Roman Empire, then gives a description of the four great existing federations, — those of the United States, Switzerland, Germany, and Canada, — and closes with a short chapter on the Latin-American federations, in which he has no great confidence The monograph is written in a good style, and shows throughout not only a careful study of the facts, but also the fruits of thought and meditation, which are not always found in American historical writings. Besides the text of the work, there is a long and elaborate appendix, containing a conspectus of the four chief existing federations mentioned above, arranged in parallel form, and giving the provisions of each of the four constitutions on every important point. This appendix thus presents a large amount of information in a form convenient for reference; and there is also another appendix containing a bibliography of federal government. Altogether, the pamphlet is a creditable one; and historical writers in our other universities will have to do better than they have done heretofore if their work is to rank on a level with these Harvard monographs.

AMONG THE PUBLISHERS.

THE latest number of the "Proceedings of the United States Naval Institute" opens with an interesting article on the protection of the hulls of vessels by lacquer, detailing the results of experiments on several Japanese men-of-war. The experiments seem to prove that lacquer is a perfect protection against the action of sea-water so long as the coat remains unbroken.

— Norman W. Henley & Co., publishers and importers of scientific and technical books (150 Nassau Street, this city), announce for immediate publication "Rubber Hand-Stamp Making and the Manipulation of Rubber," by T. O'Conor Sloane, A.M; and "Arithmetic of Electricity," by the same author. They have also in preparation the "Manufacturers', Mechanics', and Business Men's Assistant," by Benjamin Franklin, LL.B.

—Among the principal articles in the *Journal of the Military Service Institution* for January are the following: "A Practical Scheme for Training the Regular Army in Field Duties for War" (a prize essay), by Lieut. Read; "A Proposed Change in Artillery School Methods," by Lieut. Hunter; "Modern Bobadilism," by Capt. Chester; "Strategy, Tactics, and Policy" (a summary), by Lieut. Bush; "The Gyroscope and 'Drift,'" by Lieut. Richmond; "Practical Education of the Soldier," by Lieut. Parkhurst; and "The Battle of Plattsburg," by Gen. Macomb.

Publications received at Editor's Office, Jan. 5–10.

OPTICIAN, The. Vol. I. No. 1. *m.* New York, Frederick Boger. 16 p. 8°. 50 cents per year.
SCUDDER, H. E. Fables and Folk Stories. Part II. (Riverside Literature Series, No. 48.) Boston and New York, Houghton, Mifflin, & Co. 200 p. 16°. 15 cents.
SZCZEPANSKI, F. v., *ed.* Bibliotheca Polytechnica. Directory of Technical Literature. New York, Internat. News Co. 80 p. 12°.
U. S. GEOLOGICAL SURVEY, Ninth Annual Report of the, to the Secretary of the Interior, 1887–88. Washington, Government. 717 p. 4°.
UPHAM, W. Report of Exploration of the Glacial Lake Agassiz in Manitoba. Montreal, W. F. Brown & Co. 156 p. 8°. 25 cents.
VOGDES, A. W. A Bibliography of Paleozoic Crustacea from 1698 to 1889. Washington, Government. 177 p. 8°.
WATKINS, J. E. Report on the Section of Transportation and Engineering in the U. S. National Museum, 1888. Washington, Government. 5 p. 8°.
WEED, W H. The Formation of Travertine and Siliceous Sinter by the Vegetation of Hot Springs. Washington, Government. 62 p. f°.
WILSON, T. A Study of Prehistoric Anthropology.—Hand-Book for Beginners. Washington, Government. 75 p. 8°.
—— Results of an Inquiry as to the Existence of Man in North America during the Paleolithic Period of the Stone Age. Washington, Government. 26. 8°.
WRIGHT, G. F. The Glacial Boundary in Western Pennsylvania, Ohio, Kentucky, Indiana, and Illinois. (Bull. U. S. Geol. Surv., No. 58.) Washington, Government. 112 p. 8°.

CALENDAR OF SOCIETIES.

Anthropological Society, Washington.

Jan. 6.—Thomas Wilson, Stone Implements of Curious Forms from Breonio, Italy; W. Woodville Rockhill, Laws, Customs, and Superstitions of Korea.

Appalachian Mountain Club, Boston.

Jan. 14.—Frank O. Carpenter, The Stratford Mountains, New Hampshire; Frank W. Freeborn, Adirondack Paths.

New York Academy of Sciences.

Jan. 12.—John I. Northrop, The Results of a Recent Collecting Trip to the Bahamas (illustrated with specimens).

Jan. 19.—A. J. Du Bois, Science and Miracle.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—A situation in a scientific house by a graduate of the scientific department of the Jersey City High School as Geologist, Mineralogist or as assistant teacher in Physics or assistant to a chemist. Best of references. E. W. PERRY, 582 Third Street, Jersey City, N. J.

A UNIVERSITY GRADUATE IN SCIENCE, at present a junior student in medicine at the University of Michigan, desires a position as teacher or laboratory assistant. Special preparation in Zoology, Histology, Physiology and Human Anatomy. Will also teach, if desired, Physics, Chemistry, Botany, Entomology, Embryology, Bacteriology and Sanitary Science. References and full particulars on application. H. B., 20 East Jefferson St., Ann Arbor, Mich.

WANTED.—A young man wishes a position as instructor in the sciences in some school or college. Chemistry a specialty. Would like to hear of some position with a private or manufacturing chemist, in which his knowledge of chemistry would help him. Address E. E. TOWNE, B.A., 272 Worthington St., Springfield, Mass.

WANTED.—There being a considerable annual income for the purchase of books for the Museum Reference Library of Iowa College, it is desirable to have at hand any and all circulars, specimen sheets, catalogues, etc., of all works on Natural History in general, both foreign and domestic. Circulars of museum supplies, apparatus, etc., etc., desired also. State terms. Address ERWIN H. BARBOUR, Box 1338, Grinnell, Iowa.

WANTED.—A situation as Analytical Chemist is desired by the assistant of the late noted scientist, Dr. Cook, during his 15 years survey of the State of New Jersey. Highest testimonials furnished. Address Prof. EDWIN H. BOGARDUS, New Brunswick, P. O. Box 224, care Prof. F. C. Van Dyck.

COULD some one inform me what the ingredients and origin of asphalt as used for street-paving and gathered at Trinidad are? Also how gathered and shipped by natives, and mode of refining by the Warren-Scharf Co. of New York and the Barber Co. of Washington? G. KNIPER, 28 Gunn Block, Grand Rapids, Mich.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

I have a good supply of Eastern Coleoptera which I wish to exchange for species not in my collection. Melandryidal and Oedemeridal especially desired. Joe C. Thompson, Rosebank P. O., Box 73, S. I.

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1890 Seeger and Guernsey Cyclopedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost $6. David R. Lewis, Saybrook, Ill.

For exchange—Nice specimens of Unios alatus, trigonus, parvus, occidens, anadontoides gibbosus, rectus, verucosus, gracilis coccineus, ventricasus, multiplicatus and plicatus cornutus. Margaritana confrogosa, complanata, rugosa. Anadonta edentula, decora, corpulenta, and about 300 of the beautiful Ana. suborbiculata. Wanted: Unios from all parts of the world, and sea-shells. Address Dr. W. S. Strode, Bernadotte, Ill.

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SCIENCE

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A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

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THE MEDICAL PRESS ON KOCH'S CURE.

The Epidemic of Kochism.

THE fact that the new and untried method of Koch produced an immediate and world-wide sensation is perhaps not to be wondered at, but it furnishes nevertheless a very interesting study. What might, for present purposes, be called the epidemic of Kochism, first appeared in Berlin at the time of the International Congress, but remained local and dormant for about three months, when it suddenly spread with increasing force and great rapidity; taking roughly the same course as the epidemic of influenza a year ago. It appeared in America, however, before it did in France, perhaps owing to the more positive and far-reaching ubiquity of our press. It has only lately begun to be felt in the far East and South. It is yet too early to say how long it will last, but it shows signs of waning in Germany. A well-marked feature of the epidemic is a sudden revival when the first consignments of "Kochine" reach a given locality. Members of the medical profession are generally attacked a little later than the laity, and often escape altogether, except when brought into the vicinity of newly arrived Kochine. Kochism produces certain typical symptoms in members of the medical profession who are unfortunate enough to be afflicted with the malady, but our study is limited to the laity, and in fact to one class of sufferers. The effects of the epidemic on the laity differ, and show marked characteristics in different classes, especially among newspaper reporters, members of phthisical families, and irregular practitioners, among whom, by careful search, may be found symptoms which are respectively ludicrous, pathetic, and disreputable.— *Boston Medical and Surgical Journal*, Jan. 15, 1891.

The Koch Remedy for Tuberculosis.

It is now about two months since Koch made the announcement of his "remedy" for tuberculosis, and it may be said to have had a fair opportunity to show what it would accomplish. Of course, there has not been time to [illegible]res without possibility of recurrence,— years might not suffice for this,—but there has been plenty of time to show if it could produce improvement of steadily progressive character, and furnish ground for hope that eventually some form of tuberculosis would be, in a fair sense of the term, cured through its influence upon the human economy. Unfortunately, after all, it is impossible to say that the lymph can be relied upon for any of the purposes indicated by Koch in his first announcement. It is not a trustworthy means of diagnosis, nor a reliable remedy for any form of tuberculosis; while experience has demonstrated that it is dangerous when used either for diagnosis or for treatment. Professor Virchow, who has been making investigations on the lymph treatment, last week asserted, after twenty-one *post-mortem* examinations of patients who had died after injection, that the Koch method is not what had been hoped or claimed for it, and that there can be no permanent benefit from it to the patient. The tubercle bacilli, he says, are not killed by the lymph, but are only driven out to take lodgement elsewhere. Thus, according to his theory, tuberculous affections, while they may disappear from one part of the body, break out in other places in as discouraging a form as ever. To this we may add that the phenomena of certain cases, in which it has been asserted that unsuspected tuberculosis of the lungs had been revealed by treatment with the lymph, warrant the belief that the lymph may set up a tuberculous process in persons entirely free from disease.— *Medical and Surgical Reporter*, Jan. 17, 1891.

Virchow and Koch.

There is probably no one living whose opinions are listened to with the same respect as are those of Virchow, who has been so correctly called the "father of modern pathology." The statements of this eminent man are also particularly interesting when they concern the new method of treating tuberculosis, and become still more important when they seem in any way opposed to the almost ecstatic reports of the physicians who have used the mystic liquid in Germany and elsewhere. The statements of Virchow, which are published in the *Extra* attached to this number of the *Medical News*, show that a possibility exists of a sad curtailment of our hopes for the relief of the "white plague," and emphasize the fact, that, do what we will, the mortality must go on unimpeded to a very great extent.— *Medical News*, Jan. 17, 1891.

The Lymph and its Re-actions.

The publication of Professor Koch regarding the composition of the lymph, considering the great expectations which have been aroused concerning it, is rather disappointing than otherwise. Aside from the mention of the ingredients contained in the fluid, we are in little, if any, better condition as to the possibility of its production in our own laboratories than we were before. Still the information, as far as it [illegible], will add much interest to the study of the results of lymph treatment in their relations to the supposed causes of their production: in other words, we are so much the better enabled to think for ourselves, and so much the more encouraged to work in accumulating data by which the new theory must stand or fall. We are making enough progress in the latter direction to take courage accordingly, and hope for the best in the direction of eventually settling many of the mooted points of a startling revolutionary doctrine.

Much of the interest of our investigations has centred upon the value of the re-actions, general and local, as diagnostic of tuberculosis in various parts of the body. Although the

re-actionary phenomena have been quite uniform, they have proved to be far from absolutely so.

Then as to the supposed mode of action of the lymph in destroying tuberculous tissue, or scattering the bacilli, there is opportunity for much difference in opinion. The doctrine of specific action is losing rather than gaining ground in the light of present clinical experience here and abroad. Fortunately, the autopsies have been few, and pathological opportunities have been limited. So far, there have been few lesions peculiar and striking enough to show any direct relations of cause and effect in the use of the remedy. Many observers have noted no changes whatever in tuberculous joints opened by surgical operation after the lymph has done its re-actionary work, while others have described degenerative changes which may or may not have existed before the inoculation treatment was commenced. The examinations of lung lesions have shown equally various conditions from that of limited areas of injection around decomposing tubercular masses, as usually seen in cases under ordinary treatment, to that of extensive infiltration of neighboring tissue. The latter phenomena have been described also in connection with tubercular diseases of the larynx, where suffocation has been thereby threatened, and particularly in cases of lupus, in which the turgidity of surrounding parts has been almost the rule, and has been associated with incrustation of the surface.

While such effects confirm the predictions of Professor Koch regarding local re-actions, and encourage further study, we have as yet made no notable progress in ultimately curing tuberculosis, or in proving that the lymph acts differently from any other substance containing an active albuminoid substance capable of producing systemic poisoning with local manifestations. Theorizing on this basis, it would be legitimate to assume that any organic poison similar to that which the lymph contains would attack most strongly a weakened body, such as we find in tuberculous patients. The parts invaded by a degenerative disease, and necessarily most lacking in vitality, would be the first to be affected. As a consequence, strong re-actions might easily occur in the shape of increased local congestions and infiltrations, with the usual attendant phenomena of an augmented general febrile disturbance. From such a standpoint it may not be difficult to understand how the tuberculous tissue as such might be killed independently of any elective action of the lymph.

At best, we must admit that the simple destruction of the diseased tissue, even if such can always be assured, is but a part of a very complex process of cure for tuberculous disease. Something more is required than mere injections and resulting re-actions.

While we may congratulate ourselves that we have even progressed thus far, we have scarcely taken more than a first step. Much more difficult tasks are the safe elimination of the rapid local decomposition occasioned by the lymph, and the subsequent reparation of the invaded parts. Already we are told that in cases of tuberculous joints and glands relief can be obtained ultimately by surgical measures only.

What becomes of the bacilli which are not directly affected by the lymph treatment is a question of considerable importance. The statement of Virchow, that when they are routed they are scattered in adjoining sound tissue, is doubtless backed by a careful and intelligent study of *post-mortem* appearances. Until, however, more definite facts than those already offered are given, it will be well to suspend judgment.—*Medical Record*, Jan. 17, 1891.

TREES IN LONDON.

FROM a sanitary point of view, it is generally held that trees are useful, though some maintain that near houses they are often harmful from their shutting out sunlight. Whatever may be the relative value of different views put forward, observations made within the last few years seem to establish the fact that within a five-mile circle from Charing Cross the amount of foliage is decreasing. Many of the main roads leading out of London have been planted with trees, and, largely through the influence of the Metropolitan Public Gardens Association, many open spaces have been beautified by foliage. But while the number of trees placed on public ground is increasing, both the number, and, through very close lopping, the size, of trees on private ground, are decreasing; and the gains are far outbalanced by the losses.

The losses may be grouped under two heads:—

1. The cutting-down of trees completely. This is mostly due to clearances for building; and within the five-mile circle the destruction of trees in pasture-lands is small, compared with the breaking-up of gardens. In many parts houses standing in from one to two acres of ground are demolished for rows, or closely packed semi-detached villas, and the gardens are destroyed to make way for them. Recent changes in the Herne Hill district are a good typical example of this. Where three years ago there were around country houses grounds rich with timber and fruit trees, are now roads closely built on either side, with a few square yards of front that might be effectively treated with tiles and small pattern "carpet bedding," but are not large enough for trees. Instances of this kind might be quoted from many districts around London. Again, the older roads of villas, that had some twenty-five to forty feet of garden between the front door and the gate, with more at the back, are in all parts little by little being bought up to make streets which have their frontage flush with the pavement, or a depth of some three to four feet, at the most, railed off. The miles of plain fronted brick terraces built from seventy to one hundred years ago are (probably as the leases run out) being replaced by rows with their front doors leading directly from the pavement. Architecturally there may be an improvement; but the gardens, which average about thirty feet in length, are lost. Front gardens are gradually disappearing from London, and with them go the trees that used to make the public ways so changefully pleasant from bright spring to rich tinted autumn.

2. In districts where gardens remain, there is a large increase in the cutting-down and close lopping of trees. It is difficult to assign the cause for this; but whatever the explanation, the fact remains that the trees, instead of being annually pruned, are suddenly lopped, till, in hundreds of cases, they are reduced to a trunk and a foot or two, or a few inches, of branch-stumps. Few trees grow symmetrically except when isolated, and even then prevailing winds have their influence; and in towns rows of buildings have an effect similar to copses and hill contours in protection. And in many cases around London there may be seen trees so carefully tended from year to year that they but little overhang flower-beds, grow well above the pavement, and yet do not look unnaturally distorted.

Many fine elms and spreading poplars and acacias may be seen, their trunks covered with ivy or other creepers, and the lower branches carefully removed, so that sunlight falls on the small garden, and the lower rooms have light. It would seem that want of management while trees are young is one of the causes of ignorant lopping being resorted to; and another, that forest-trees have been planted where fine-leaved and small-habit trees would have been more appropriate.

It can be easily observed that the increasing number of public trees are periodically attended to, while private trees are disappearing piecemeal, or being entirely swept away. London has, in the last few years, gained in planted open places; but the acreage does not equal the small lawns, grass-plots, shrubs, and trees lost.

A GENERAL exhibition of the Kingdom of Bohemia is to be held this year at Prague, this being the centennial jubilee of the first trades exhibition on the continent at Prague, in 1791. The exhibition will last from May until the 15th of October, 1891.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

The Flight of Birds.

ONE would suppose that there could be little difference of opinion in regard to such fundamental principles of avian flight as the direction in which the down-stroke of the wings is delivered, and the relative positions to a horizontal plane of the anterior and posterior margins of the wings during this and the up-stroke. Nevertheless the other day I was completely astounded at some ideas expressed in "Animal Locomotion; or, Walking, Swimming, and Flying," by G. Bell Pettigrew, M.D., F.R S., F.R S.E., F.R.C.P.E., and connected with several other scientific and educational institutions (International Scientific Series, 1888).

Never having happened to see any review or remarks upon this remarkable work, I am in ignorance of how it has been received by the scientific world. To me it appears so completely illogical in parts, that I cannot refrain from presenting these remarks; so that, if I be as completely mistaken as to me appears to be this author, some one may kindly put me aright, that my ignorance of some fundamental points of aerostatics and animal mechanism may not vitiate my further observations in this line. It is with considerable diffidence that I venture to advance my opinion against that of one who has spent some twenty years upon the subject, and who, judging by the position that he occupies, certainly should be capable of coming to satisfactory conclusions on the subject; but my utter inability, after considerable study of the matter, to admit the possibility of what is given as the main principle of avian flight, induces me to bring the matter forward.

I will put the case in the author's own words, here as elsewhere, with his Italics (p. 197): "*Reasons why the effective stroke should be delivered downwards and forwards.*— The wings of all birds, whatever their form, act by alternately presenting oblique and comparatively non-oblique surfaces to the air,— the mere extension of the pinion, as has been shown, causing the primary, secondary, and tertiary feathers to roll down till they make an angle of 30° or so with the horizon, in order to prepare it for giving the effective stroke, which is delivered with great rapidity and energy, in a *downward* and *forward* direction." My first impression was that such a movement would drive the bird upwards and backwards, and subsequent study of the subject only makes me the more positive of this. Theoretically I believe that any body suspended in a fluid medium will tend to move in a direction opposite to that in which the medium is forced by the members of that body. Take a wing of a bird and vibrate it rapidly, as its movements are described by Dr. Pettigrew, before the flame of a candle, and we shall find that the flame is driven downward and forward.

On p. 95 we are told, "In the water the wing, when most effective, strikes *downwards* and *backwards*, and acts as an auxiliary of the foot; whereas in the air it strikes *downwards* and *forwards*." I fail to see why a movement that produces locomotion in one direction in water should be reversed in the air to produce locomotion in the same direction; and my mystification is increased when I read on p. 108, "Flight may also be produced by a very oblique and almost horizontal stroke of the wing, as in some insects, e.g., the wasp, blue-bottle, and other flies," for here I am left in doubt whether opposite directions of applying the wing produce the same direction of locomotion, or whether I am to believe that an "almost horizontal stroke of the wing" forwards produces a forward movement of the body. For the present I am inclined to believe neither the one nor the other. Again, on p. 204, in the explanation of Fig. 107, we read, "The Red-headed Pochard (*Fuligula ferina*, Linn.) in the act of dropping upon the water; the head and body being inclined upwards and forwards, the feet expanded, and the wings delivering vigorous short strokes in a downward and forward direction.— *Original.*" The questions presented to my mind by this are these: "Does the duck really wish to increase its speed just before alighting upon the water, or does the fact of the strokes being 'vigorous short strokes' diametrically change their effect on the body from what would be produced by leisurely short strokes or vigorous long strokes?" I imagine that if the bird were in its right mind it would wish to check its course,— in other words, to give an upward and backward impulse to its body before coming in contact with the water, — and I should approve of its giving downward and forward strokes to its wings in order to accomplish this end.

Many other of Dr. Pettigrew's illustrations, both pictorial and verbal, also do violence to my ideas without convincing me: in fact, I seem to see exactly the opposite in them to what he has found. For instance: in Figs. 53 and 54, illustrating the action of the wing, the hinder edge of the wing must be below the anterior on the up-stroke and above it on the down-stroke, which is exactly the reverse of what he tells us occurs in flight. On pp. 156 and 157 we read, "It is a condition of natural wings; and of

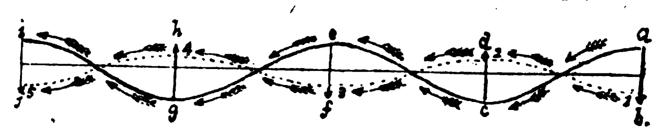


FIG. 1 (FIG. 81 IN ORIGINAL).

artificial wings constructed on the principle of living wings, that when forcibly elevated and depressed, even in a strictly vertical direction, they inevitably dart forward. This is well shown in Fig. 81. If, for example, the wing is suddenly depressed in *a vertical direction*, as represented at *a b*, it at once darts downwards and forwards in a curve to *c*, thus converting the vertical down-stroke into *a down oblique forward stroke*. If, again, the wing be suddenly elevated in a strictly vertical direction, as at *c d*, the wing as certainly darts upwards and forwards in a curve to *e*, thus converting the vertical up-stroke into an *upward oblique forward stroke*. The same thing happens when the wing is depressed from *e* to *f*, and elevated from *g* to *h*." Admitted. But the posterior margin of the wing must be elevated during this movement, or one of two things must take place. If this margin be depressed, the wing will move in a contrary direction; i.e., backwards and downwards. If this does not take place, then force must be used which will cause an appreciable upward and

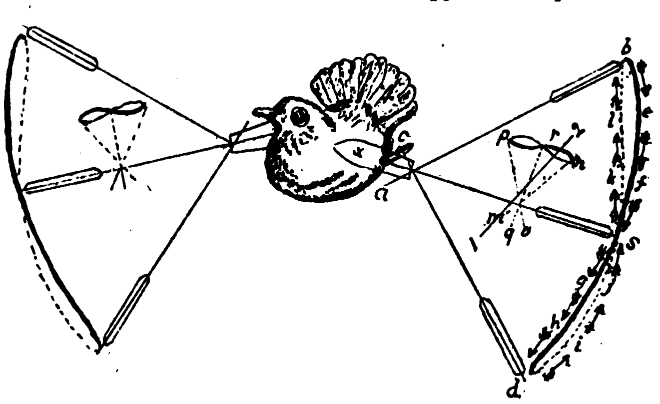


FIG. 2 (FIG. 116 IN ORIGINAL).

backward recoil to the hand moving the wing. In the same way the posterior margin of the wing will be lower than the anterior instead of above it, as the author states, during the upward stroke of the wing. Also I had imagined that the buoyancy and progression of a bird depended on the resistance that the wing encountered. If it be allowed to move in the plane of least resistance, it will move forward while the body remains stationary; whereas if not allowed to move forward, or forced slightly backward, then, and only then, can a forward impulse be given to the body. I might cite my personal observations of the movements of the wings of flying birds against the observations of Dr. Pettigrew; but in that case he would have in his favor the longer length of time during which his observations have taken place.

To draw the discussion to a close, which, if I am in the wrong, has sufficiently exposed my ignorance, I will call attention to Fig. 116. On p. 231 we read, "Instead of the two wings forming one

cone, the base of which is directed *forwards*, each wing of itself forms two cones, the bases of which are directed *backwards* and outwards, as shown at Fig. 116. In this figure the action of the wing is compared to the sculling of an oar, to which it bears considerable resemblance.[1] The one cone, viz., that with its base directed outwards, is represented at *x b d*. This cone corresponds to the area mapped out by the tip of the wing in the process of *elevating*. The second cone, viz., that with its base directed backwards, is represented at *q p n*. This cone corresponds to the area mapped out by the posterior margin of the wing in the process of *propelling*. The two cones are produced in virtue of the wing rotating on its root and along its anterior margins as it ascends and descends (Fig. 80, p. 149; Fig. 88, p. 158). The present figure (116) shows the double twisting action of the wing, the tip describing the figure of 8 indicated *a b c f g h d i j k l;* the posterior margins describing the figure of 8 indicated at *p r n*." We readily see that the cone *x b d* is formed by the downward or elevating stroke, the wing passing from *a b* to *x s* and *c d*. It is an elevating power both because of the direct lifting-power of the wing from *a b* to *x s*, and because of the action of the two wings on the wedge or cone of air formed by the line *c d* and its correspondent of the opposite side. In this case the wing is in each of its positions extended on the lines *a b*, *x s*, and *c d*. But I can't as readily explain the cone *q p n*. That this transverse section of the wing does not run parallel to the lines *o p*, *q r*, and *m n* if its edge be turned downward on the down-stroke and upward on the up-stroke, is evident. The down-stroke is the propelling one. Let us see how it produces the cone. I have added the line 1 2 to the figure to represent the position of a transverse section of the wing during its downward course. As we have been told that the primaries, secondaries, etc., roll down into this position upon the wing being extended, and as the wing is extended nearly at or upon the commencement of the down-stroke, we find that the plane of this section cuts the line *o p* at an angle of about 60°, the line *q r* at an angle of about 30°, and only becomes parallel to *m n*. Then here, as elsewhere, I have shown, we have very opposite causes producing the same effect. Now, let us see what really would be the result of this. We are told that the wing works upon compressed air, that "it produces a whirlwind of its own upon which it acts," etc. Let *q p n* represent, then, the cone of compressed air. The wing 1 2, cutting into this cone at the angle which it does, will of necessity be forced backwards towards the base *p r n*, instead of gliding along *o p*, as it would were its posterior margins elevated so that its plane lay in the direction *o p*. The same state of affairs, only reversed, would take place during the upward stroke of the wing.

In this discussion I have considered the wing as having a flat surface. That it is somewhat screw-shaped, i.e., twisted upon its axis, does not altar, so far as I can see, any of the principles here involved. It appears to me that during all of the discussion of flight Dr. Pettigrew has entirely failed to distinguish the difference between an active and a passive organ. In the inclination of the wings he has reasoned as though the air was acting on the wings instead of the opposite state of affairs, which occurs in active flight, where the wings act upon the air.

There are numerous other points in aerial, aqueous, and terrestrial locomotion where I cannot help thinking that our author has erred; but, as none of them involve such fundamental principles as have here been discussed, I will not now allude to them.

HENRY L. WARD.

Tacubaya, D.F., Mex., Dec. 30, 1890.

" [1] In sculling, strictly speaking, it is the upper surface of the oar which is most effective, whereas in flying it is the under."

The American Idea of Architecture.

THE statement in a recent issue of the *Record and Guide*, that the dominant conditions of American architecture "are not those that make for the greatest beauty, or for the highest health, or for charm, but for the largest return in cash," is a most alarming indication of the estimation in which architecture is held in this country. Coming from so eminent a source, it carries additional weight, and shows very clearly that even those who by profession are nominally responsible for all that is great or good, poor or indifferent, in the important art of architecture, have given up hope of elevating it to the broader platform which it occupied in past times; and surely, if the doctors have admitted the patient incurable, it is obviously unwise for an outsider to maintain the contrary.

This utterance of the *Record and Guide* is an admission from exalted quarters that in architecture all considerations must be sunk save those of dollars and cents. It shows, what indeed may be gathered any day in a brief walk through almost any street of our chief cities, that the idea of art quality, of utility, of the natural effects of the environment, and many similar causes whose influence is to be traced in all the good architecture of previous periods, are quite wanting in the art of the present day and generation. It is an indication of indifference to every thing but cost, of measuring art values and art qualities by the price per square inch, or, which is much the same thing, by the revenue per square foot,— most necessary to keep in mind, but altogether improper in judging of architectural merits. The point to be remembered is not the falseness of this criterion, not its absurdity, but the candid admission by an undisputed authority that it is the cardinal principle in American architecture, and that it is useless to contend against it. And, indeed, it might well be so; for if this idea has become firmly rooted in the minds of those who are concerned with architecture, who are erecting buildings as well as designing them, it is impossible to look for any better results than we have already obtained.

There is not only a popular misconception that architecture is a matter of cost, but also that it is concerned chiefly with the exteriors of buildings, and is not a science of plan, convenience, use, and similar influences. It is not the least surprising that a people who view their architecture through the medium of price should believe that the whole of it should be visible to the world at large in the exterior of their structures. That the American public is prone to judge of architecture by external æsthetic qualities is quite evident from the recent exhibition of the Architectural League in New York. This body is composed of the leading architects in the city, and its work is naturally the product of the best architectural culture in the country. Its annual exhibitions are looked upon by that section of the public interested in the serious treatment of architectural ideas as authoritative indications of whatever progress may have been made in American architecture during each year. Certainly the *personnel* of this society, and the names of those who send their work to its exhibitions, are sufficient justification for the estimation in which it is held. The exhibition that has just closed cannot be viewed as at all satisfactory to the public it was designed to instruct; and this, not because the work shown was of an inferior quality, not because it was lacking in firm, intelligent treatment, or was deficient in ideas, but because the drawings consisted solely of exteriors and picturesque effects.

It is not in the least critical of the work shown, to remark, that, in confining itself to these aspects of architecture, this important body of American architects has given its formal sanction to the idea that if a building looks well, all has been done that is needful to make it good architecture. On no other grounds does it appear possible to explain the predominance of exteriors in this collection. It is to be admitted that the artistic treatment of exteriors is one of the most important problems the architect has to deal with; but it is only one, and architecture has to do with many. It is not unreasonable to insist that it is quite as important to cover a given area well as to erect a façade that extends upwards into space for any desired distance. There is, however, a widely extended opinion that architecture is a matter of outsides, and is not at all of what is within. The outlook for American architecture is, in truth, discouraging when such a view receives the official support of an eminent body of architects.

It is not to be supposed that so advanced a journal as the *Record and Guide* should be backward in presenting the same idea. In a late issue it gave a review of the work done on the west side of New York, the seat of the most active building operations in the metropolis, in which, out of sixty-four illustrations, forty-nine were of exteriors, twelve bits of interiors, and three plans. It

would seem to be indisputable, then, that the American people are satisfied with their buildings if the outsides are good-looking. The structures illustrated in the *Record and Guide* include private residences, apartment-houses, hotels, warehouses, and churches, any one of which must have required some ingenuity in arrangement of plan, and have had some interesting constructive details, but they are carefully hidden from those who should be interested in these essential portions of architecture.

These indications of the tendency of American architecture show very clearly where the error is. The needs of the public are heeded in almost every phase of modern life and thought. The manufacturer and the shop-keeper, not less than the editor and the artist, are continually on the lookout for what the public wants, and hasten to supply them as soon as manifested. The public evidently want only exteriors in architecture. Plans, use, environment, and other matters which were once pre-eminent in the art, are now at a discount. Until the popular mind frees itself from such erroneous ideas, it will be impossible for the art to make any progress. It is well to remember that the general public which is satisfied with such things is more to blame for their continuance than the architects who prepare the designs; but it is a serious retrogression when the architects join the popular movement, and give their assent and support to it by catering to its most objectionable features. BARR FERREE.

School of Architecture, University of Pennsylvania, Jan. 8.

Cyclones and Anticyclones.

IT seems to me that the discussion in regard to the origin of cyclones and anticyclones that has been in progress in *Science* and other journals for several months past opens up a question that has so long been regarded as settled, that it seems impossible to look upon it as being in doubt. It is, in short, as to whether gravitation is the chief cause of movements of the air. Barometric observations have directed attention so forcibly to the relative weights of columns of air in storm-centres and elsewhere, that it has been assumed as a matter of course that the pressure gradients thus made manifest are the occasion of the horizontal movement apparent as wind. If this be the true explanation, in order that such horizontal movement may continue, it is necessary that there be a corresponding vertical movement, and that it be sustained by adequate renewal of the buoyancy of the air in the proper localities. This renewal of buoyancy can only be accomplished, so far as our knowledge at present extends, by heating. But now we are informed as a matter of fact that the air at anticyclonic centres descends in spite of its being warmer at an elevation, and in like manner above cyclonic centres fails to descend, although colder than at the surface of the earth. This certainly opens up the entire question as to whether there is ascensional movement at storm-centres commensurate with the extent and velocity of the winds blowing horizontally, and supposed to be due to an indraught; or, in other words, whether gravitation really plays the part that has been tacitly assigned to it, or whether it must be relegated to a subordinate position. Personally I am very glad indeed that a discussion having such bearings has come up at this particular juncture, because it has increased very decidedly my interest in following certain clews that look promising in regard to the effects of variations of the earth's magnetic condition as a whole. M. A. VEEDER.

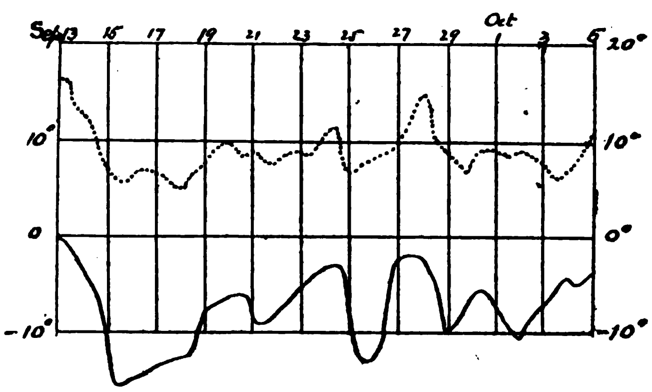
Lyons, N.Y., Jan. 5.

Dr. Hann and the Condensation Theory of Storms.

THE time has not yet come for a review of the various discussions upon this subject that have been published during the past four years. I doubt if there has ever been a better illustration, in the history of meteorology, of the absolute necessity there exists of appealing to observations in order to establish intricate theories, than the recent discussions on the reversal of temperature in our storms and "highs," which is but another way of putting the problem before us. In this very line Professor Davis says (*Science*, Jan. 2), "Records of temperature made on high mountain-peaks furnish the best means of testing the convectional theory of cyclones; for, even if all other tests were successfully borne, failure under this test would be fatal to the theory." This statement of the case should be received with a little caution, however, because the presence of the mountain must be a modifying cause, and oftentimes there are cases in which some part of the storm, or high, has its action below the mountain-peaks (I have found this true especially at Pike's Peak); but the larger commotions of the atmosphere may be profitably studied at such points.

In carrying out my studies on this problem, I have invariably sought for help from the original records, which are now so abundant at Mount Washington, Pike's Peak, and at many high stations in Europe, and I have massed thousands of observations bearing on the question. The first publication of these studies was in the *American Meteorological Journal* of August, 1886, in which I showed that the temperature observations at the base and summit of Pic du Midi, in France, indicated a decided rise at both points on the approach of a storm. In October of the following year I showed by the observations at Mount Washington that in both storms and highs there was the same fluctuation at the summit as on the base, and that the mean temperature of the air-column was ten to twelve degrees higher in storms, and the same amount lower in highs, than before or after the centre had passed.

It seems to me that the crucial test in Dr. Hann's recent work, which has attracted so much attention, must be the records at the mountain stations, and I believe that this will be insisted on by Dr. Hann himself as strongly as by any one. In fact, Dr. Hann has based all his work on his interpretation of the records.



TEMPERATURE FLUCTUATIONS, 1889.

Sonnblick, full curve; Salzburg, dotted curve.

It seems to me that he has given altogether too much weight to a few isolated cases, while he has ignored hundreds of cases which disprove his propositions. I have already shown in this journal for Sept. 5, 1890, that the evidence at Sonnblick is different only in degree from that in this country, and I have there explained how the peculiar results in the remarkable high of barometer, 1889 (which, in fact, was the only one in three years exhibiting such discordances from the usual law), might be accounted for. I have now made a special study of the storm of Oct. 1, 1889, which Dr. Hann advanced as favoring his view, that the temperature in a storm falls as we rise in its centre, and at some height is lower than that of the surrounding region. The results of this investigation so remarkably corroborate my position, that I present a copy of the curves in order that others may see the exact state of the case.

These curves are constructed as follows. The lower or full curve represents the temperature observation for each day at Sonnblick, 3,095 metres (10,154 feet), at 9 P.M., at which time very nearly the mean for the twenty-four hours occurs; and the upper or dotted curve shows the temperature at precisely the same time at Salzburg, just north of Sonnblick, at a height of 437 metres (1,434 feet). I have given the curves from Sept. 13 to Oct. 5, including the storm of the 1st. It will be seen that there is a most remarkable accordance between these curves; almost every bending at the base is faithfully reproduced at the summit; and, if any thing, there is generally a greater fluctuation on the mountain than on the plain. This is not all, however. Examining the very date under discussion, Oct. 1, we find that at Sonnblick the temperature began rising on Sept. 29, and in twenty-four hours had risen

4.2° C. (7.6° F.); in the next twenty-four hours it fell 1.4° (2.5° F.), and then fell 3.2° (5.8° F.), or a fall of 8.3° F. in forty-eight hours. It seems to me that no more positive disproof of Dr. Hann's position could be found than these very observations which have given rise to so much discussion. Here is the temperature higher in the centre of a storm than before and after it, both at base and summit, exactly in accordance with theory, and directly opposed to Dr. Hann's position.

Dr. Hann has tried to fortify his position by stating the fact that in this storm the average temperature was 4° C. below the thirty-years' normal, and this temperature was lower than that in a high nearly two months later. As I showed in this journal for June 6, 1890, "the temperature in a vertical direction in a storm is not fixed, but may be ten degrees, or even more, lower than the average, and yet be many degrees above that of the surrounding region. That the temperature in an October storm was lower than in a November high area is not in any wise remarkable." This position is exactly the one taken more recently by Professor Ferrel (*Science*, Dec. 19); so that we see that on all accounts Dr. Hann's position is entirely untenable, and his disproof of the condensation theory, if it amounts to any thing, is a direct proof in its favor, as shown by the records. H. A. HAZEN.

Washington, Jan. 7.

The Practicability of transporting the Negro back to Africa.

A LITTLE more than a year ago there appeared in the columns of *The Open Court* of Chicago some very excellent articles upon the question as to the methods we should adopt in handling our African population in the future. There were two sides taken in the premises,— those in favor of making the attempt to assimilate this mighty host of millions of negroes we now have in our midst; and those in favor of sending him back to the land of his ancestors. In the opinion of the present writer, the most able of all these articles came from the pen of Professor Cope, and in the main we completely coincide with the views that that far-seeing thinker puts forth.

Professor Cope's reasons for returning the African to Africa are most cogent indeed, and are stated in a philosophic and masterly manner. He lifts himself far above the state of the case as seen by the short-sighted party politician, or the sentimental hopes of the idealist or philanthropist, and, calling history and science to his aid, shows most conclusively that we incur a great danger in quietly submitting to the continued presence of this race of people among us. It is not my object here to enlarge upon his ably stated argument, for he has shown with marked precision and strength the dangers of hybridization of the white and black races in this country, and the constantly disturbing element the negro is in our national organization. By far the greatest danger, however, comes from the mixture of the two races; and that such is now going on, one has to but study the population of a city like Washington to appreciate.

It is to be most devoutly hoped that in the very near future the pressing necessity of taking early action in this matter will be fully recognized; and, when such comes to be the case, the practical question will surely arise as to the best ways and means of accomplishing the transfer. Little has been written upon this point as yet, though we all know that the proper exercise of ability, of energy, and the use of sufficient money, will effect it. It seems to me that the first steps that should be taken are those of an organization of an extensive American expedition to Africa, to primarily report upon the best available areas for colonization, taking conditions of climate and for future improvement into consideration. Such an expedition would have many decided advantages; for, in addition to making a well-organized initial move for the removal of the negro to his proper home, it would give America an opportunity to reap the national benefits that flow from such exploration,— credit of a nature that we now stand greatly in need of, as our last African expedition was practically a puerile failure. Finally, it would give scientific employment to several of the huge and expensive battle-ships we are now constructing, and for which there is no other especial employment in these days of peace, beyond an exhibition of power.

The next step should be in the direction of constructing a sufficient number of comfortable and commodious steamers by means of which the transfer could be made; and upon their completion, the necessary national legislation should be promptly enacted that would efficiently result in the removal of every negro in this country to those parts of the African continent selected for them. The settlement for such personal properties as the comparatively few negroes could justly lay claim to in the United States could be easily settled. It would not create a circumstance aside similar financial problems that we have most promptly and satisfactorily solved in former times.

We do not need the negro vote; we do not need his labor; and, least of all, do we need the injection of his lowly blood into our veins. On the other hand, "Darkest Africa" can well stand, and with the greatest benefit, the introduction into her fertile valleys and upon her fair hillsides, of the very material she most requires to inaugurate her development; that is, several millions of the descendants of her people, which, for a century and a half, have enjoyed the tuition of the most highly civilized race upon the face of the globe. R. W. SHUFELDT.

Takoma, D.C., Jan. 2.

["Letters to Editor" continued on p. 50.]

NOTES AND NEWS.

AN exhibition at Grolier Club, 29 East 32d Street, New York, of books on alchemy and early chemistry belonging to Dr. H. C. Bolton, is announced to close Monday, Jan 26; open afternoons from two to six o'clock.

—Dr. Don José Nicolas Gutierrez, founder of the Cuban Academy of Medical, Physical, and Natural Sciences at Havana, died Dec. 31, 1890, at the age of ninety. The rector of the university, and Professor Poey of the same, still live,— one at the age of ninety, the other ninety-one.

—Owing to their greatly increased trade in New York, George L. English & Co., mineralogists, have leased rooms at 733 and 735 Broadway (within three doors of their former location), in which they have more space than heretofore in their Philadelphia and New York stores combined. The consolidation of the two stores, and the formal transfer of the business, were made on Jan. 1. Mr. Niven, a member of the firm, started Dec. 13 on another collecting-trip to the South-west and Mexico.

—The question has been asked, "Does the weather of Kansas divide itself into seven-year wet and dry periods?" Another question that has been asked, and it is an important one too, is, "Is the rainfall of Kansas increasing?" And it is the object of a paper by E. C. Murphy, C.E., Kansas University, Lawrence, Kan., to answer these questions as correctly as the rainfall records of the State will permit, in which he concludes from the record of the observations thus far taken, that the law of seven-year wet and dry periods does hold in Kansas, and also that the rainfall is steadily increasing in Kansas.

—The next meeting of the American Branch of the Society for Psychical Research will be held at the Association Hall, corner of Berkeley and Boylston Streets, Boston, Mass., on Tuesday, Jan. 27, at 8 P.M. The following papers will be read: "Report of Some Recent Experiments in Automatic Writing," by T. Barkworth, to be read by the secretary; "Report of Some Sittings with Mrs. Piper in America," by R. Hodgson. No admittance except by ticket. Extra tickets may be obtained by members or associates on application to the secretary, Richard Hodgson, 5 Boylston Place, Boston, Mass.

—Staff-Commander J. G. Boulton, R.N., who has, since the autumn of 1883, been engaged in a hydrographic survey of the Georgian Bay, during the past season completed a large proportion of the work yet remaining to be done, being that part of the east coast from Indian Islands to Moose Deer Point, and including the important harbor and approaches of Parry Sound. The part not yet completed comprises the south-east extremity of the bay, lying south-eastward of a line joining Moose Deer Point and Point Rich, of which the most important portion is Matchedash Bay. Two charts have just been issued by the British Admiralty, covering the work done by Capt. Boulton in 1889. One of these embraces

the coast from Collins Inlet to McCoy Islands, including the harbors of French River, Byng Inlet, and Point au Baril. In consequence of the shoal water, low land, and innumerable islands in this sheet, navigation is very difficult, and the extremely broken character of the coast line shows the immense quantity of work involved in making a thorough survey of this district. The second chart referred to shows St. Joseph's Channel north of St. Joseph Island, and will be of great use to American as well as Canadian shipping. It includes the western limit of Capt. Boulton's work, the west extremity of the sheet connecting with the American Coast Survey charts.

— At the meeting of the French Academy on Dec. 8, as we learn from *Nature* of Jan. 1, 1891, M. Mascart presented a work by Gen. A. de Tillo on the distribution of atmospheric pressure in the Russian Empire and Asia from 1836 to 1885. The work consists of an atlas of 69 charts, and a discussion of the monthly and annual values, as well as of the variability of pressure, and the relations existing between the variations of pressure and those of temperature at 136 stations. The highest pressure quoted is 31.68 inches (reduced to sea-level), in December, 1877, at Barnaoul; and this is stated to be the highest reading on record. But in the *Quarterly Journal of the Royal Meteorological Society* for July, 1887, Mr. C. Harding quoted, on the authority of Professor Loomis, a reading of 31.72 inches on Dec. 16, 1877, at Semipatalinsk. In *Nature*, vol. xxxv. p. 344, Mr. Blanford quoted the lowest reading on record at any land station, viz., 27.12 (reduced to English standards), which occurred on Sept. 22, 1885, on the coast of Orissa. These readings give a difference of 4.6 inches, probably the maximum range of the barometer ever observed at the earth's surface.

— A microscopical study by Herr Schultz, of the skin of toads and salamanders, has yielded some interesting results. As stated in *Nature*, there are two kinds of glands,— mucus and poison glands. The former are numerous over the whole body ; while the latter are on the back of body and limbs, and there are groups in the ear-region behind the eye, and in the salamander at the angle of the jaw. The mucus-glands are spherical, have a clear, glassy appearance, and contain mucus-cells and mucus: the poison-glands, which are in regular strips on the salamander, are oval, much larger, and have a dark, granular look, from strongly refractive drops of poison, a good re-agent for which is copper-hæmatoxylin. The poisonous elements are from epithelial cells lining the glands. The mucus-glands are for moistening the skin; and the liquid has no special smell, nor a bitter or acid taste. The poison-glands are, of course, protective ; and the corrosive juice is discharged differently in toads and salamanders, on stimulating electrically. In the latter it is spirted out in a fine jet, sometimes more than a foot in length ; whereas in the toad, after longer action of the current, it exudes sparingly in drops. The physiological action of the poison has lately been studied by some Frenchmen. There is no reason, according to Herr Schultz, for supposing that the mucus-glands sometimes become poisonous.

—At a meeting of the Biological Club of Columbus, O., Jan. 5, Professor Lazenby gave a report of the twenty-fourth annual meeting of the Ohio State Horticultural Society, recently held at Zanesville, saying that the principal interest seemed to centre in three subjects,— new varieties of fruits; the use of fungicides; and cross-fertilization, especially between the peach and cherry. It was the decision of fruit-growers present that for them the older, standard varieties are still much better than many of those of only recent advent in the horticultural world. For the parasitic fungi, which do such great injury to many of our fruit-trees and vines, it was recommended to spray with a solution of sulphate of copper and ammonia. All the difference in a fruit-crop between success and failure may be seen by comparing those orchards and vineyards which have been sprayed with those which have not. For cross-fertilization it may be said that the experiment of crossing the peach and cherry was successful in eleven instances last spring at the Ohio State University. Mr. W. C. Werner next spoke of the varieties of the beautiful little evergreen, much used for hedges, the arbor-vitæ (*Thuyia occidentalis*). Mr. C. P. Sigerfoos described two Indian graves recently opened in a gravel pit near the western extension of Lane Avenue at North Columbus. These graves were in a cultivated field situated on a promontory near the Olentangy River at the new bridge just above the college farm. One contained the skeleton of a man about twenty-five years of age, and the other that of a woman of about sixty years. Each had evidently been buried in a sitting posture; and the hand of the man was supported toward the mouth with a mussel-shell near it, as though it had been intended to serve as a drinking-vessel for the entombed individual on his journey to the land of the Great Spirit. The bottom of this grave was at least seven feet beneath the surface of the ground, so the head was covered by about three feet of soil. For about one foot under the skeleton was found disturbed gravel and dirt, and beneath this was yet two or three inches of ashes and cinders. The charcoal, one piece being two and one-half feet long, showed that there had been a fire which was smothered by the material thrown over it. The woman's grave showed no evidences of fire beneath it, although such were found above in the form of cinders mixed with the material with which the grave was filled. No relics whatever were found excepting some pieces of pottery in each grave.

—In a report to the British Foreign Office, recently published, Col. Stewart, the British consul-general at Tabreez, calls attention to the curious system of lakes in that region, situated at a great elevation above the sea-level. According to *Nature* of Jan. 8, these are the lake of Urumia, situated 4,100 feet above the sea, Lake Van, and the Guektcha lake. Lake Van is in Turkish territory, and the Guektcha lake in Russian territory, though both are near the bottom of the Persian province of Azarbaijan, in which is situated the lake of Urumia, the largest and most important. It is 84 miles long and 24 miles broad, and is probably the saltest piece of water on earth, being much salter than the Dead Sea. The water contains nearly 22 per cent of salt. Its northern coasts are incrusted with a border of salt glittering white in the sun. It is said that no living thing can survive in it, but a very small species of jelly-fish does exist in its waters. Many streams pour down from the Kurdish Mountains, which border Turkey, and render the country between them and the lake of Urumia very green and fertile. This part of the country looks more like India than Persia, but the climate is severe in winter. The whole country being situated from 4,000 feet to 5,000 feet above ocean-level, the snowfall in winter is great. At night in winter the thermometer falls frequently below zero of Fahrenheit, but in the day-time it rises considerably, generally reaching 28° or 30°, and this with a bright sun over head. Many people are frozen to death on the roads in winter while crossing the various passes. The winter climate may be compared to that of Canada, but the summer approaches that of northern India.

—The wren is generally supposed to be a gentle little bird, yet on occasion it seems capable of displaying any thing but an amiable temper. In the Selborne Society's magazine, Mr. Aubrey Edwards gives from his note-book the following account (quoted in *Nature* of Jan. 1) of what he calls "a disgraceful scene" between two male wrens: "April 15, 1889.—I have just been watching two golden-crested wrens fighting. They first attracted my attention by getting up from the ground almost under my feet, and engaging again and falling to the ground. Then rising again, one chased the other into a yew-tree near, where I had a good close view of them as they challenged each other, ruffling their feathers, shaking their bodies, singing and dancing about with crests erected, the sun shining on the orange-colored crests,—such a pretty sight! After they had been talking big at each other for some minutes, the hen arrived on the scene, and a desperate fight ensued, the two cocks falling to the ground in fierce embrace, rolling over each other occasionally, but for the most part lying still on the ground with their claws buried in each other's feathers for about a minute. The hen was close by them on the ground, moving about, and looking very much concerned at the affray. Her pale-yellow crest contrasted notably with the rich orange of the males. After getting up, renewing the combat in a currant-bush, falling again, and struggling on the ground, they rose and had a chase round the yew-trees, the hen following to see the fun, and presently went off and were lost to view."

SCIENCE:

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CONTENTS:

THE NEW YORK *Evening Post* published, in its issue of Jan. 9, a letter from Cornell University which has a singular tone, and makes most remarkable statements. It asserts that some of the ablest professors in the literary branches of the university are proposing to resign, because, as they state, they are unable to see that progress in their own departments which has for some years past distinguished the technical schools of the university. It is said, that, although the academic departments have been continually strengthened by the addition of new departments and of able men to the staff of professors and instructors, these departments still fall behind the others in their rate of growth. This state of things is attributed to the fact that the price of tuition has been increased, though it is not stated why this increase should affect their departments more than others. In all institutions of learning the cost of the technical instruction has been from the first, both to the institution and to the student, greater than purely literary instruction; and the flocking of students into them, in spite of this disadvantage, is as observable in other colleges as in that from which this curious complaint comes. The real state of the case is, we are confident, that the establishment of technical education meets the need and fulfils the desires of a very large proportion of young men who have no inclination to defer going into business for the purpose of getting an education of the older sort, — a mistake, we think, — but who are keen enough to see that certain branches of business must be most successfully pursued by those who have had the professional preliminary training, not education in the usual sense of that term, which is required to give the novice a good hold upon its principles and practice. The profession of engineering, for example, has become a learned profession; and the graduates of these professional schools are more carefully and remorselessly sorted out from the great mass than are those who desire to enter either of the older, so-called learned professions. Engineering schools often graduate not more than one-third their entering classes. It is not at all likely that acute and learned professors are proposing to leave any such good positions as are held at Cornell, or other great universities, on this account. The fact is, that the state of things noted is perfectly natural and proper; and the result is, that every professor of ability and ambition takes advantage of his good fortune in having smaller classes to prosecute his studies and his researches, and thus to teach the world, as well as his own students, both better and more widely. Any such positions vacated in any of our colleges will be gladly taken by brighter men who seek just this opportunity.

LETTERS TO THE EDITOR.

[Continued from p. 48.]

The Skeleton in Armor.

PROFESSOR ANDERSON was correct in saying that the skeleton, immortalized by Longfellow, was discovered at Fall River, Mass., in 1831; and not in 1837, as Mr. Beauchamp states on p. 26 of your last number (Jan. 9, 1891).

The actual date of the discovery was April 26, 1831, and the earliest account of it was published in *The American Magazine*, vol. iii. p. 434 (August, 1837). This was copied into Barber's "Historical Collections for Massachusetts," p. 128; and from that source Col. Stone transferred it to his "Life of Brant." This may account for Mr. Watson's having omitted Stone from his list of authorities. Subsequently, in 1839, several other skeletons were discovered in about the same locality, near the boundary-line between Fall River and Tiverton, R.I., accompanied by precisely similar objects as the first. The original skeleton, which had been preserved in the Museum of the Troy Athenæum ("Troy" was the old name of Fall River), was destroyed by a fire about the year 1843. Some of the relics discovered with the skeletons disinterred in 1839 are now to be seen at the Redwood Library in Newport. These different discoveries of similar interments, some years apart, have occasioned the confusion of dates.

A few years ago a skeleton was discovered at Centreville, on Cape Cod, with a brass breastplate precisely like the one originally found in 1831. This is described by Henry E. Chase in the "Smithsonian Report," 1883, p. 902.

It is worth noticing, that besides the "flat, triangular arrowheads of *sheet copper*," to which Mr. Beauchamp refers as having been recently found in the Iroquois district of New York, similar in shape to those made of brass disinterred with the skeleton in 1831, like objects, also made of sheet brass, have not infrequently been met with in other localities (see ABBOTT'S *Primitive Industry*, p. 420; JONES'S *Antiquities of the Southern Indians*, p. 251; *Reports of the Peabody Museum*, ii. p. 732, iii. pp. 85, 195; *Reports of Long Island Historical Society* (1878–81), p. 40; *Smithsonian Report*, 1883, p. 901).

We learn whence the Indians procured the brass of which these arrow-heads were fabricated, from the account given in Underhill's "History of the Pequod War" (*Collections of Massachusetts Historical Society* [3d series], vol. vi. p. 17), who tells us that a Dutch trader was prevented from bartering with the Pequods on the ground that they were to be supplied in part with "kettles, or the like, which make their arrow-heads." Sir Ferdinando Gorges, earlier than this, had complained about "disorderly persons," who sold the savages "arrow-heads and other arms" ("Description of New England," *ibid.* p. 70).

The earliest notices of the Indians often speak of their arrows as being headed with brass. This was the case with those "taken up" and sent to England in the first encounter of the Pilgrims

with them (MOURT'S *Relation*, p. 55 [Dexter's edition]). William Wood (*New England's Prospect*, part ii. chap. xvii. p. 101) speaks of them as made of this material: so does the Rev. Francis Higginson ("New England's Plantation," in YOUNG'S *Chronicles of Massachusetts*, p. 257).

Undoubtedly the Indians found it easier to cut up brass kettles for this purpose than to pound out with their stone hammers pieces of native copper. This they were in the habit of doing, according to Brereton ("Brief and True Relation of the Discovery of the North Part of Virginia," in *Collections of Massachusetts Historical Society* [3d series], vol. viii. p. 91).

HENRY W. HAYNES.

Boston, Jan. 13.

Meteorology and Mathematics.

AT a time when the tide of meteorological controversy in your columns runs high and the general outcry is for revision of the old theories,— all apparently because Dr. Hann last spring made some erroneous deductions from observations in the Alps, which has not convinced anybody (*vide* Hazen),— you may permit me to add my small share to the general conflagration, out of the ashes of which the true Phœnix may some day be expected to rise in all its glory.

What I here wish to sacrifice on the altar of truth is the so-called mathematical treatment of the circulation of the atmosphere; and I take occasion from a letter by William Ferrel in your issue of Jan. 2, wherein the writer complains that Dr. Hann has never attempted to show that his results have been deduced from erroneous principles or processes.

I am not aware that any mathematician has ever attempted to show, on rational mechanical principles, what would be the motion of a body of air moving over the surface of a rotating globe,— not over the free and empty surface, but on the bottom of the air universally enveloping and rotating with this globe, being part and parcel of this air itself,— but I think it can be shown, by looking ever so little into the true nature of this subject, that the problem is far more complicated than Professor Ferrel seems to imagine.

As the speed wherewith places at different latitudes on the earth's surface rotate differ in proportion to their distances from the axis, so it is concluded by Ferrel and others that a particle of air is deflected towards the east when moving towards the poles, and towards the west when moving towards the equator.

In proportion, however, as the speed of rotation of the particle of air changes while it moves from latitude to latitude, so also the centrifugal force to which it is exposed changes; and therefore, if a change in the former should have the effect of deflecting a current of surface air laterally, so also the effect of the latter must be to deflect the current in a vertical direction. The result hereof is that all pole-bound currents should appear as upper currents, and the surface wind should always be directed more or less towards the equator, and never in the opposite direction. This, however, does not agree with observations. There is a continuous current of surface air round the border of any anticyclone, while in strict consequence of Professor Ferrel's theory we should only expect to find this current round one-half the circumference of the high pressure, the other half being deflected into an upper current.

According to the way the writer was taught applied mathematics (a discipline, by the way, incomparably more difficult to master than mathematics itself), it is not admissible to pick out one of the forces acting upon a body in motion, and ignore another of equal importance, simply because it does not suit our purposes.

In a paper, "On the Cause of Trade-Winds," read before the American Society of Civil Engineers Dec. 18, 1889 (see "Transactions," vol. xxiii. August, 1890), the writer allowed himself to suggest how the gyratory motion of the surface air might be accounted for independently of a supposed effect of the earth's rotation, which theory, as we have just seen, doesn't bear closer inspection; and one of America's most eminent engineers, Mr. Charles Macdonald, got up at the meeting, and declared the explanation given the only rational one he had ever heard, and well worth the most careful study. I therefore beg to call the reader's attention to the contents of this paper; and, by comparing my diagrams with the isobaric charts over the North Atlantic for the autumn of 1889, he may see the reason why Dr. Hann found the temperature of the anticyclonic air in the Alps so exceptionally high.

FRANZ A. VELSCHOW, C.E.

Brooklyn, Jan. 7.

The Education of the Deaf.

SPOKEN language is the product of the mind enjoined with the enjoyment of all the senses. Its acquisition is facilitated through the sense of hearing, but the latter is not indispensable to it; and to its reproduction by the deaf (without its musical intonation) a normal throat and mouth are requisite. Dr. Gillett says, "This [intelligence] the deaf-mute has perfectly" (*Science*, Dec. 26, p. 355). As most of the deaf possess these requirements, the question that now arises is this: "Is it expedient to invent an artificial sign-language, which of course presupposes articulate speech, in order to impart the latter to the deaf?" Emphatically, no. The oral schools now in existence in this country prove this fact beyond the shadow of a doubt. One of Dr. Gillett's objections is this: "For, while he [the deaf] may utter distinct articulate sounds for others to receive, he cannot receive them himself, and is consequently thrown back upon the visible movements of the superficial parts of the organs of voice, which are chiefly the lips" (*Science*, Dec. 26, p. 357). The deaf will read from the lips-mouth readily when spoken to without voice, that is, mutely; and it is a phenomenon that they are enabled to recognize even the distinction between being addressed audibly and mutely. They will often converse mutely with each other in the school-room, when desirous of not being overheard by their teacher. Lately one of my patients happened to be a Chinaman. On inquiring of him what he uses at his meals, — a fork and a knife, or chop-sticks,— he said that at home he uses the latter, but when eating at a restaurant he uses the former. Early education and impressions are lasting. The same is applicable to those mutes who are educated by the combined system, where an artificial sign-language forms the basis of instruction. When a mute educated by that system meets a deaf-mute who was taught by the oral system, the former will naturally address the latter by signs. To start the conversation, the first question perhaps will be, "Do you know Mr. P—t?" The sign for "Mr. P—t" is this: closing the thumb and all the fingers except the forefinger, with which he taps himself at the temple. The other repeats the sign for "P—t," shakes his head, and indicates by expressions that he does not know what this sign means; then the former spells with his fingers the words "P—t, teacher;" and such conversations may occur so often that the one learns the meaning of signs from the other. The deaf educated by the oral system become so ambitious that they make efforts when in a small circle of society, by constant watchfulness, to follow the connection of the conversation, and try to hide their infirmity. They are even ashamed to use signs. I would gladly go extensively into the details of Dr. Gillett's article on the education of the deaf, but the pressure of professional duties will not permit me to devote the time necessary. I would like, though, to direct Dr. Gillett's attention to Hon. Gardiner G. Hubbard's article in *Science* of Dec. 19, to which I have to make the one exception only, that the first oral school in this country was established in this city, and was in operation in the fall of 1864 at No. 427 (old number 415) Eighth Avenue, consisting of two boarding and three day pupils.

B. ENGELSMAN.

New York, Jan. 8.

BOOK-REVIEWS.

The Science of Fairy Tales. By EDWIN SIDNEY HARTLAND. New York, Scribner & Welford. 12°. $1.25.

THIS volume is the latest issue in the Contemporary Science Series, and may be described as an attempt to group and classify the various stories of Celtic and Teutonic origin relating to elves and fairies, with illustrations from the stories of other nations. Mr. Hartland opens his work with a few remarks on savage ideas,

especially on the subject of spirits, and then proceeds to relate a large number of the tales, grouping them so far as possible, and aiming particularly to show how similar they are all the world over. The first class of stories dealt with are those that relate how human midwives are often snatched away and taken to fairyland to assist at the birth of fairy children. Then come the stories of changelings and babies stolen by the fairies, followed by tales of other robberies by the fairy-folk, as well as of robberies perpetrated or attempted by mortals against the fairies. Stories of men being put to sleep for years and even centuries, as in the case of Rip Van Winkle, occupy a considerable space, and the list is completed by two chapters on the swan maidens.

Thus the greater part of the book is taken up with the tales themselves, and we are rather disappointed at the meagre attempts to explain them. A few discussions appear here and there, and a brief concluding chapter sums up the author's theories, so far as he has any theories to offer; but one cannot help feeling as he closes the book that the "science of fairy-tales" is as yet hardly entitled to that name. Mr. Hartland has indeed marshalled a great body of facts on his chosen theme, and his book is written in a style that will make it attractive to all that are interested in its subject. But it must be remembered that facts are not science,— they are only the materials of science,— and that the real aim of the scientist is to explain the facts. Mr. Hartland shows very clearly that folk-tales bear a similar character everywhere, and that they must therefore be attributed to certain intellectual and moral characteristics common to all tribes of men; but what those characteristics are he does not even inquire. He ascribes the origin of the tales to the primitive belief in spirits,— but that is merely using the genus to account for the species,— and gives no real explanation at all. It is evident that the most difficult work connected with the subject is yet to be done; but meanwhile those who wish for a large and well-arranged collection of the facts will find it in the book before us.

Educational Review. Vol. I. No. 1. January, 1891. Ed. by NICHOLAS MURRAY BUTLER. *m.* New York, Henry Holt & Co. 8°. \$3 a year; 35 cents a number.

The Pedagogical Seminary. Vol. I. No. 1. January, 1891. Ed. by G. STANLEY HALL. Worcester, Mass., J. H. Orpha. 8°. \$4 a year; \$1.50 a number.

WE have had in this country for many years a number of educational periodicals, but they have been of inferior character, and some of them practically worthless. There is room, therefore, for a new and better one; and the general interest now manifested in educational matters makes the present an opportune time for starting such a work. Two journals of the kind have now appeared in magazine form, one from a private publishing-house, the other from Clark University; and even a slight examination will show that they are superior to any thing of the sort that we have had in America hitherto. Whether and how far they will supply the existing need cannot be determined from the contents of the first numbers; but these give evidence of thought as well as of reading, and show that the editors of both are in earnest in their new undertakings. They are, however, quite different in character, and we shall therefore consider them separately.

The *Educational Review* opens with a number of essays; then follow brief discussions, editorial and otherwise; next comes a series of book-notices; and, last of all, a few extracts from foreign periodicals. Most of the articles are fairly well written, though none have any special merit of style, and some contain suggestions and criticisms of real interest. The book-reviews are similar to those that appear in the best newspapers, and will doubtless prove an attractive feature of the magazine. The notes and discussions present some good points, but one or two of those in the editorial department are marred by too much dogmatism. The least successful papers are the essays, not one of which is really satisfactory, their brevity being inconsistent with a proper treatment of their respective subjects, while most of them have the air of having been written to order. President Gilman writes on "The Shortening of the College Curriculum," intimating his opinion that it can perfectly well be shortened, but without suggesting any thing very definite. William T. Harris contributes a strangely narrow and shallow article on "Fruitful Lines of Investigation in Psychology," and also a book-review of similar tenor. We hope that these articles are not a sample of the way the *Review* will treat philosophical themes "Is there a Science of Education?" by Josiah Royce, is the first of a series of articles, and contains little besides vague generalities; but the author promises in future numbers to treat some more definite aspects of his subject. Superintendent Andrew S. Draper discusses "The limits of State Control in Education," and makes some suggestive remarks; but his paper is far too brief for a proper treatment of its theme. The last of the essays is by Charles de Garmo, on "The Herbartian School of Pedagogics," and bids fair, when completed, to give a good synopsis of Herbart's views; though whether these views are of much value admits of question. On the whole, the *Educatioual Review* bids fair to be useful; but we hope to find the essays in future numbers more elaborate and thorough.

The Pedagogical Seminary consists in the main of notes on the educational systems and theories of other countries. It opens with an editorial on the aim and purpose of the *Seminary*, followed by a paper, also from the editor, on "Educational Reforms;" while the rest of the number is mainly devoted to the study of recent changes in the schools and universities of foreign countries, and of foreign discussions on educational topics. The editor and his associates seem to desire and anticipate great changes and reforms in our own educational system, especially in its higher departments; but they leave us in great uncertainty as to what specific changes they wish for. However, they have here collected a mass of information which can hardly fail to be useful to educators, and which may suggest beneficial reforms in our schools. One cannot help asking, though, why President Hall and his associates have started this little publication of their own, when the *Educational Review* would have served them well as a medium for addressing the public. As the *Seminary* is to be published only three times a year, it will not contain a great deal of matter, and its fusion with the *Review* would seem to be easy as well as desirable. But however published, and from whatever source they may come, real contributions to our educational literature are certain to be welcome.

The Future of Science. By ERNEST RENAN. Boston, Roberts. 8°. \$2.50.

THIS book is not just what its title would lead us to expect. It contains very little about physical science, and nothing whatever about its future: on the contrary it relates almost exclusively to the sciences of mind and society, and the future of religion. M. Renan takes the ground that the highest degree of intellectual culture is to understand humanity, and this work is written from that point of view. It is not a new work, however, but was composed forty years ago, when the author was young; and it has many of the characteristics that we should expect to find in a work coming from such a source. It is written in the author's usual diffuse and rambling style, and with rather more than his usual flippancy; and the views it expresses are those with which readers of his other books are familiar.

M. Renan starts with the assumption that "there is no such thing as the supernatural," and consequently that every thing that has hitherto been called religion is destined to pass away. "The religion of the future," he says, "will be pure humanism." God is "the category of the ideal." "In the future the word 'morality' will not be the proper word. . . . I prefer to substitute the word 'aestheticism.'" In short, to lead an intellectual life and pursue the scientific and artistic ideals is the only religion that is now left to us. Such is the opinion of M. Renan, which he reiterates without the least suspicion that he may be mistaken. Moreover, it appears that he himself, even at the age of twenty-five, had already reached perfection; for he says, "I, as a man of culture, do not find any evil in myself, and I am impelled spontaneously towards what seems to me the most noble. If all others had as much culture as myself, they would all, like myself, be incapable of doing an evil act" (p. 333).

But our readers must not suppose that the book contains nothing better than the above-quoted passages. On the contrary, when the author leaves the question of the future religion, and talks

about history and philology, the importance of criticism, and the need of educating the masses, he says much that is interesting and valuable. The necessity of examining and criticising traditional views is strongly emphasized, and the great value of philology as an instrument of such criticism is clearly shown. The history of religions is mentioned as one of the most important subjects of investigation; and it appears that the author had, even at that early age, projected his work on the origins of Christianity. Plutocracy is declared to be the main cause of our slow intellectual development; yet wealth is recognized as essential to culture, and endowments for investigators are advocated. The finest passage in the book is that in which the author pleads for the intellectual culture and elevation of the masses, which he deems perfectly feasible; but in his preface, which was written quite recently, he intimates that on this point, as on some others, he had been too optimistic. On the whole, though the book contains some excellent passages and useful suggestions, it will not add to the world's knowledge nor to the author's reputation.

AMONG THE PUBLISHERS.

ANOTHER proof that American scientific work is appreciated abroad is shown by the translation, by Dr. Victor von Richter of the University of Breslau, of a handbook of electro-chemical analysis, recently issued in Philadelphia by Professor Edgar F. Smith of the University of Pennsylvania.

— Mr. F. G. Barry has sold his monthly magazine, *College and School*, to Louis Lombard of Utica, N.Y. The next number will appear Feb. 15, entitled *The Louis Lombard.*

— P. Blakiston, Son, & Co., Philadelphia, have just issued a second edition of "Diseases of the Digestive Organs in Children," by Louis Starr, M.D., and of "Water Analysis for Sanitary Purposes," by Drs. Leffmann and Beam, both containing new material and many additional illustrations. They have also just ready "Gynæcology," being No. 7 of their compend for medical students.

— J. Scott Keltie, librarian of the Royal Geographical Society, London, will have an article, "About Africa," in the February *Scribner*, with the London African Exhibition for a text. A rare portrait of Livingstone, taken in 1860, will be the frontispiece of that issue, and the article will contain several portraits (never before engraved) of African explorers, from the private collection of John Murray, Esq., the London publisher.

— Sir Edwin Arnold, describing a Japanese dinner, says, in the February *Scribner*, "You are at last surrounded by twenty or thirty dishes, like a ship in harbor by a fleet of boats; and the best of a Japanese dinner is, that, after flitting like a butterfly from flower to flower of the culinary *parterre*, you cannot only come back to any thing that has originally pleased, but leave off to smoke and chat, and then commence again, if you like, at the very beginning. When everybody has had enough, particularly of saké, the substantial part of the repast has still to arrive, for the Japanese. The last saké bottle is removed and *gohan* is brought, the honorable, great white tub with hot, boiled rice. Along with it re-appears fresh tea; and each native guest will consume two bowls of rice, and then another, amply saturated with tea."

—The February *Chautauquan* will contain, among other articles, "British India," by R. S. Dix; "England after the Norman Conquest," Part II., by Sarah Orne Jewett; "The English Towns," II., by Augustus I. Jessopp, D.D.; "A Peasant Striker of the Fourteenth Century," by Charles M. Andrews; "The Constitution of Japan," by William Elliot Griffis; "Studies in Astronomy," V., by Garrett P. Serviss; "The National Academy of Sciences," by Marcus Benjamin; "The Relation of the Family to Social Science," by John Habberton; "France in Tunis," by Edmond Plauchut; and "New England and Emigration," by Edward Everett Hale.

—The *Westminster Review* for January (Leonard Scott Publication Company, New York) opens with a paper on "Patriotism and Chastity," by Elizabeth Cady Stanton, for which recent events in Irish politics furnish a text. A paper on "A Privileged Profession" points out the advantage nursing offers to women. An exhaustive article on "The Decline of Marriage" deals with the relations between marriage and culture, and presents some conclusions that will attract wide attention. R. Seymour Long writes on the "Continuity of Parties in English History," and Frederick Dolman on "Hereditary Peers and Practical Politics." An essay on "The Social and Political Life of the Empire in the Fourth and Fifth Century," recalls the early days of this ancient though ever young review. In the department of "Contemporary Literature," books are reviewed in science, philosophy and theology, sociology, history and biography, and belles lettres. The number closes with its usual review of current English politics.

— Mr. Theodore Roosevelt has written for the Historic Towns Series, which Professor Freeman edits, and which the Longmans publish, the volume on "New York," to appear at once. Mr. Roosevelt shows incidentally that the admixture of races now to be seen in the city is no new thing, as the population was quite as heterogeneous in the beginning, and has been much the same at every stage of New York's growth.

— In *The Atlantic Monthly* for February, 1891, Professor Royce's second "Philosopher of the Paradoxical" is Schopenhauer. He treats Schopenhauer's place in the world of thought. Mr. Percival Lowell's "Noto" is continued, and the traveller at last arrives at the turning-point, but not the end, of his journey. Alice Morse Earle has a paper on "The New England Meeting-House," which is full of curious bits of information. Mr. Alpheus Hyatt writes on "The Next Stage in the Development of Public Parks," in which he advocates the allowance of space for a collection of living animals grouped for the uses of the student. William Everett has an article on "The French Spoliation Claims;" and Theodore Roosevelt, in "An Object-Lesson in Civil-Service Reform," tells about the work of the National Civil Service Commission for the last year, and its success in gaining a large number of applicants from the Southern States to enter the civil-service examinations.

— Messrs. E. & F. N. Spon (New York) announce an illustrated descriptive catalogue of their scientific publications relating to civil and mechanical engineering, arts, trades, and manufactures, which they will send on application; also a "Handbook for Mechanical Engineers," by Henry Adams; "The Municipal Buildings, Glasgow," by William Young, architect, with twenty collotype illustrations by Bedford, Lemere, & Co.; "Practical Electrical Notes and Definitions," for the use of engineering students and practical men, by W. Perren Maycock, together with the rules and regulations to be observed in electrical installation work, as issued by the Phœnix Fire Office and the Institution of Electrical Engineers (second edition, revised and enlarged); "Tables to find the Working Speed of Cables; comprising also Data as to Diameter, Capacity, and Copper Resistance of all Cores," by Arthur Dearlove (these tables have been computed from formulæ which have for some time been used by Messrs. Clark, Forde, and Taylor, and are based on the mean results recently obtained in the commercial working of long cables); "Light Railways as a Practical Means of Exploration," by E. R. Salwey, in which the author's desire is to bring prominently forward the suitability of narrow-gauge railways as an inexpensive and economical means by which countries already explored may be rapidly civilized, and their known resources developed; and "Surveying and Levelling Instruments Theoretically and Practically Described," by William F. Stanley.

—In the *Fortnightly Review* for January (Leonard Scott Publication Company, New York) A. Mounteney Jephson makes a new contribution to African literature in an article on "The Truth about Stanley and Emin Pacha," in which he refutes some charges brought against Mr. Stanley. Ernest M. Bowden writes on "Scientific Sins." E. B. Lanin, whose papers on Russia have been a strong feature in the *Fortnightly* in the past year, describes the country and people of Finland. Edward Delille presents some reminiscences of literary evenings in Paris, entitled "'Chez Pousset:' a Literary Evening." James D. Bourchier describes a voyage on the Black Sea with Prince Ferdinand, with accounts of Bulgarians and strange sights. Sir George Baden Powell writes on "The Canadian People," and considers the possibility of Can-

ada's ultimate absorption in the United States. Frederic Harrison has a brief paper on "The Irish Leadership;" and Irish affairs receive further consideration in an article by the Hon. Auberon Herbert, entitled "'The Rake's Progress' in Irish Politics."

—The next number of the "Publications of the American Academy of Political and Social Science" will contain an interesting article on "The Idea of Sovereignty," by Professor Ritchie of Oxford. It is specially flattering to Americans that so eminent an authority plants himself squarely on the doctrine of the sovereignty of the people,—an idea first advanced in modern times by American jurists. It is another evidence of how rapidly American political ideas are permeating and leavening European thought. Professor Ritchie is evidently a careful student of American constitutional development, and the academy is doing valuable work in introducing such authors to our American public.

—The *Nineteenth Century* for January, published by the Leonard Scott Publication Company, New York, begins the new year with a paper by the Duke of Argyll, entitled "Professor Huxley on the War-Path," in which the author takes the professor to task for some of his theological criticisms. Lieut.-Gen. Sir William F. Drummond writes on "Home Rule for the Navy," which, while especially a suggestion for the English Navy, is not without value to those interested in our own system. Lieut. W. G. Stairs contributes some leaves from his African diary, entitled "Shut up in the African Forest," relating some thrilling adventures and experiences while waiting for Stanley. H. Arthur Kennedy writes on "Velasquez and his King," with special reference to Philip and his encouragement of art. David F. Schloss discusses the merits of the Jew as a workman. Viscount Lymington presents some questions of forestry in an article on "Vert and Venery." The Earl of Meath describes labor colonies in Germany, with notes on a very interesting phase of social economy. Dr. George C. Kingsbury has an article on "Hypnotism, Crime, and the Doctors," dealing with some questions of professional ethics. Norman Pearson writes on "Animal Immortality;" and the number closes with a brief paper by Edward Dicey, on "The Rival Coalitions."

—Sir Morell Mackenzie contributes a review of Dr. Koch's "Treatment of Tuberculosis" to the *Contemporary Review* for January (Leonard Scott Publication Company, New York). The author points out the real merit of the discovery, and shows how erroneous it is to call it the "consumption cure." Professor Bryce's address before the Brooklyn Institute, on "An Age of Discontent," is also printed in this number. Frank H. Hill writes on "Home Rule and Home Rulers;" and politics are further considered in a paper by L. J. Jennings, entitled "Behind the Scenes in Parliament." R. Bosworth Smith discusses Englishmen in Africa, and what they have done there. Julia Wedgwood describes the revival of Euripides at Cambridge. The Rev. H. W. Clarke writes on "Public Landed Endowments of the Church." R. Anderson discusses morality by act of Parliament; and Professor J. Agar Beet, the certainties of Christianity.

—The next number of the "Annals of the American Academy" will contain an article by Professor Ashley of Toronto which will prove of special interest to all students of social economy. It is well known that Henry George, and the labor agitators and pessimists in general, delight in representing the condition of the workingman to-day as a sad one, to which he has been brought by the despotism of the better-situated classes. They refer with feeling to the ideal state of the English laborer in the fourteenth century, and contrast it with his present down-trodden condition. Professor Ashley deals this theory a ponderous blow, for he shows that the English laborer of that time was practically a slave, with no rights which his lord was bound to respect, and that, so far from his condition growing worse in the eyes of the law, it has steadily become better since that time.

Publications received at Editor's Office, Jan. 12-17.

AMATEUR Electrician. Vol. I. No. 1. *m.* Ravenswood, Ill., Amateur Electrician Co. 16 p. 8°. $1 per year.
COLOR in the School Room. A Manual for Teachers. Springfield, Mass., Milton Bradley Co. 12°.
EDUCATIONAL Review. Vol. I. No. 1. January, 1891. Ed. by Nicholas Murray Butler, Ph.D. *m.* New York, Holt. 104 p. 8°. $3 per year.
HARTLAND, E. S. The Science of Fairy Tales. New York, Scribner & Welford. 372 p. 12°. $1.25.
HARVARD University Catalogue. 1890–91. Cambridge, Mass., The University. 444 p. 12°.
HYATT, A., and ARMS, J. M. Guides for Science-Teaching. No. VIII. Insecta. Boston, Heath. 300 p. 16°. $1.
LADD, G. T. Outlines of Physiological Psychology. New York, Scribner. 505 p. 8°. $2.
MISSOURI Botanical Garden. St. Louis, State. 165 p. 8°.
NORTH DAKOTA, First Annual Report of the Commissioner of Insurance of the State of. 1890. Bismarck, State. 443 p. 8°.
NORTON, C. L. A Handbook of Florida. New York, Longmans, Green, & Co. 380 p. 16°. $1.25.
OHIO, First Annual Report of the Geological Survey of. Columbus, State, 1890. 328 p. Maps. 8°.
PEDAGOGICAL Seminary, The Vol. I. No. 1. January, 1891. Ed. by G. Stanley Hall, Ph.D. *tri-m.* Worcester, Mass., J. H. Orpha. 118 p. 8°. $4 per year.
RENAN, E. The Future of Science. Boston, Roberts. 491 p. 8°. $2.50.
STONE, A. Good Roads: How they can be had in Rhode Island. Salem, Mass., Salem Press Pub. Co. 23 p. 8°.
U. S. Board on Geographic Names. Bulletin No. 1. Issued December 31, 1890. Washington, Smithson. Inst. 13 p. 8°.
U. S. NAVAL OBSERVATORY, Report of the Superintendent of the, for the year ending 1890, June 30. Washington, Government. 108 p. 8°.

—D. C. Heath & Co., Boston, will at once add to their series of Modern Language Texts, Sandeau's "Mlle. de La Seiglière," with introduction and English notes by F. M. Warren, Ph.D., associate in modern languages in the Johns Hopkins University. This edition, of a text-book now recommended in the requirements for the New England colleges, is prepared with the demands of rapid reading in mind.

— Dr. Daniel G. Brinton of Philadelphia has now in press a work entitled "The American Race: a Linguistic Classification and Ethnographic Description of the Native Tribes of North and South America." It is the first attempt ever made to classify all the Indian tribes by their languages, and it also treats of their customs, religions, physical traits, arts, antiquities, and traditions. The work comprises the results of several years of study in this special field.

— The Scientific Publishing Company, New York, announce that they have acquired the copyright and plates of all the works of Dr. T. Sterry Hunt, and will hereafter have the exclusive sale of these admirable books. The works now ready are "Chemical and Geological Essays," second edition; "Mineral Physiology and Physiography," second edition; "A New Basis for Chemistry," third edition; and, now in preparation, "Systematic Mineralogy based on a Natural Classification."

—Sister Rose Gertrude, the young woman about whose work among the lepers of Molokai so much has been written, has been induced to reply to the charges made against her for renouncing her work. Her article, the first from her pen, is to be published in *The Ladies' Home Journal* for February, and will contain a full explanation of what she has accomplished among the lepers, and why she was obliged to forsake her work. As a sort of supplementary chapter to his "Looking Backward," Mr. Edward Bellamy has written an article for the same issue, under the title of "Women in the Year 2000," in which the famous nationalist will sketch woman, marriage, courtship, etc., as they will be regarded in the year 2000. Emma C. Thursby, Clara Louise Kellogg, Madame Albani, Campanini, and Maud Powell will each have an article giving some vocal helps and musical hints to girls and women with musical aspirations.

— Messrs. Ginn & Co. announce "Sketch of the Philosophy of American Literature," by Greenough White, A.M. This essay aims, as its preface explains, to point out the connection between our country's literature and history, and to show how new forms in letters and arts have arisen as advancing thought required, — a task not attempted hitherto. It may be used as a key to the whole subject, as well as to the excellent and extended treatises upon it and the numerous compilations that have recently appeared. It is believed that it will interest the general reader (it can be read at a single sitting), and that the experienced teacher will find it highly valuable in inculcating in more advanced classes habits of sound and scholarly appreciation of American intellectual life.

— The good results which sometimes follow the combination of several competing business interests were the subject of some remarks by George R. Cathcart of the American Book Company, to a recent correspondent of the *New York Tribune*. This company is an amalgamation of three school-book publishing-houses in New York, and one from Cincinnati. When it was formed, the prediction was freely made that the price of school-books would go up. Mr. Cathcart says, however, that, so far from this being the case, their enlarged facilities have enabled them to put the price of school-books down from ten to twenty per cent. He further says that competing firms have been obliged to follow suit, with the result that the New York Board of Education, which buys $50,000 worth of supplies from his concern; the Brooklyn Board, which purchases $40,000; and the Philadelphia Board, which is a customer to the extent of $30,000, — have all been benefited to the extent of many thousands of dollars.

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Jan. 17.—C. V. Riley, Bacteriology in Applied Entomology; H. A. Hazen, The Lawrence, Mass., Tornado of July 26, 1890; Asaph Hall, Note on (ζ) Cancri.

Women's Anthropological Society of America, Washington.

Nov. 8, 1890.—Mrs. Anita Newcomb McGee, The Papers presented before the Anthropological Section of the American Association for the Advancement of Science.

Nov. 22, 1890.—Clara Bliss Hinds, The Influence of Systematic Exercise upon Women.

Dec. 6, 1890.—Miss Cleveland Abbe, Psychology in its Physiological Analysis; Mrs. Thomas Wilson, The Béguinage of Ghent.

Jan. 3, 1891.—Miss Alice C. Fletcher, A Study of the Negro Race.

Jan. 17.—Miss Clara Rogers, The English Cottage System.

Boston Society of Natural History.

Jan. 21.—A. E. Dolbear, The Physics of Crystalline and Cellular Structure.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED—Employment or partial employment as naturalist collector for all Ornithological, Entomological or Zoological specimens. First class Canadian references supplied. Would be willing to work in Canada or any part of America as desired. Salary or commission. G. E. ATKINSON, 639 Spadina Ave., Toronto, Can.

WANTED.—A situation in a scientific house by a graduate of the scientific department of the Jersey City High School as Geologist, Mineralogist or as assistant teacher in Physics or assistant to a chemist. Best of references. E. W. PERRY, 582 Third Street, Jersey City, N. J.

A UNIVERSITY GRADUATE IN SCIENCE, at present a junior student in medicine at the University of Michigan, desires a position as teacher or laboratory assistant. Special preparation in Zoology, Histology, Physiology and Human Anatomy. Will also teach, if desired, Physics, Chemistry, Botany, Entomology, Embryology, Bacteriology and Sanitary Science. References and full particulars on application. H. B., 20 East Jefferson St., Ann Arbor, Mich.

WANTED.—A young man wishes a position as instructor in the sciences in some school or college. Chemistry a specialty. Would like to hear of some position with a private or manufacturing chemist, in which his knowledge of chemistry would help him. Address E. E. TOWNE, B.A., 272 Worthington St., Springfield, Mass.

WANTED.—There being a considerable annual income for the purchase of books for the Museum Reference Library of Iowa College, it is desirable to have at hand any and all circulars, specimen sheets, catalogues, etc., of all works on Natural History in general, both foreign and domestic. Circulars of museum supplies, apparatus, etc., etc., desired also. State terms. Address ERWIN H. BARBOUR, Box 1333, Grinnell, Iowa.

WANTED.—A situation as Analytical Chemist is desired by the assistant of the late noted scientist, Dr. Cook, during his 15 years survey of the State of New Jersey. Highest testimonials furnished. Address Prof. EDWIN H. BOGARDUS, New Brunswick, P. O. Box 224, care Prof. F. C. Van Dyck.

COULD some one inform me what the ingredients and origin of asphalt as used for street-paving and gathered at Trinidad are? Also how gathered and shipped by natives, and mode of refining by the Warren-Schart Co. of New York and the Barber Co. of Washington? G. KNIPER, 28 Gunn Block, Grand Rapids, Mich.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

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I have a good supply of Eastern Coleoptera which I wish to exchange for species not in my collection. Melandryidae and Oedemeridae especially desired. Joe C. Thompson, Rosebank P. O., Box 73, S. I.

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1890 Seeger and Guernsey Cyclopedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost $6. David R. Lewis, Saybrook, Ill.

For exchange—Nice specimens of Unios alatus, trigonus, parvus, occidens, anadontoides gibbosus, rectus, verucosus, gracilis coccineus, ventricasus, multiplicatus and plicatus cornutus. Margaritana confrogosa, complanata, rugosa. Anadonta edentula, decora, corpulenta, and about 500 of the beautiful Ana. suborbiculata. Wanted: Unios from all parts of the world, and sea-shells. Address Dr. W. S. Strode, Bernadotte, Ill.

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[Entered at the Post-Office of New York, N.Y., as Second-Class Matter.]

NINTH YEAR.
VOL. XVII. No. 417.

NEW YORK, JANUARY 30, 1891.

SINGLE COPIES, TEN CENTS.
$3.50 PER YEAR, IN ADVANCE.

CALENDAR OF SOCIETIES.

New York Academy of Sciences.

Jan. 26.— J. A. Allen, The Geographical Distribution of North American Mammals; Frank M. Chapman, The Origin of the Avifauna of the Bahamas.

St. Louis Club of Microscopists.

Jan. 8, Election of Officers.— President, J. C. Falk; vice-president, A. C. Speth; secretary, Frank Davis; treasurer, Otto Meyer; curator, William Ilhardt.

Mr. Meyer exhibited slides of sachet powders and of *Fucus versicolosus*; Dr. H M Whelpley exhibited a slide of peacock silver and several others of interest.

Women's Anthropological Society of America, Washington.

Jan. 24, Election of Officers.— President, Miss Alice C. Fletcher; first vice-president, Mrs. Anna Howes Barus; second vice-president, Mrs. Mary Parke Foster; recording secretary, Mrs. Susan A Mendenhall; corresponding secretary and librarian, Mrs. Mariana P. Seaman; treasurer, Miss Florence P. Spofford; board of directors, Mrs. Mary Olmstead Clarke, Mrs. Miranda Tullock, Mrs. Jean M. Lander, Dr. Clara Bliss Hinds, Miss Sarah A. Scull, Miss Lydia M. Dame.

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WANTED. — One first-class instrument-maker. Apply by letter to T. C. MENDENHALL, Superintendent U. S. Coast and Geodetic Survey, Washington, D. C

WANTED.—A Botanist and Entomologist to accompany a camping party of boys during July next. Address, stating experience and salary expected. ALBERT L. AREY, Free Academy, Rochester, N. Y.

WANTED.—A young man wishes a position in an experiment station. botanical department preferred. References and evidence of competency on application. Address E. E. BOGUE. Agr. Experiment Station, Columbus, O.

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SCIENCE

FRIDAY, JANUARY 30, 1891.

DEAF-MUTES: THEIR INTERMARRIAGE AND OFFSPRING.

DR. ALEXANDER GRAHAM BELL says (*Science*, Dec. 26, 1890), "I cannot agree with Dr. Gillett that it is not a very great calamity to have a deaf and dumb child." I never made that statement, and shall not make it now. What I have said is, that what was once a calamity is now; to those deaf persons who improve the privileges and opportunities they enjoy under our civilization, reduced to a very serious inconvenience. Dr. Bell says, "The deaf themselves surely will not indorse it." I am glad to say, and I hope Dr. Bell will be glad to know, that some very intelligent deaf persons whom I have the pleasure of knowing, and some others whom I have never seen, do indorse it in letters to me since its publication. One gentleman whom I never saw writes me, "I have read your article in *Science*, Dec. 26. Allow me, as a man deaf, to express my most hearty approval of all you protest against for ever holding up the deaf as victims of a terrible misfortune, and objects of commiseration and charity. As I read the article, so intensely do I sympathize with every word, that I could scarcely refrain from dancing around the room with delight." Another, whom I am proud to number among my former pupils, a man filling an honorable and important station in life, who has for many years been battling with the world and well maintaining his family, writes, "Now, my dear doctor, I want to thank you for your very able article in *Science*, Dec. 26. The whole mute population is under everlasting gratitude to you for the noble and able stand you have taken." A lady (married) writes, "I have read your article on the intermarriage of the deaf with deep interest. May the Lord inspire you more and more to plead the cause of the deaf, and show you in a way that will counteract the plausible reasoning of other learned men, who think they know just what is proper for us, and would legislate us into marriage with hearing persons, and rob us of more domestic happiness than their theories would secure us in a thousand years, if we could live to that age." Another gentleman, writing me with reference to my article, says, "I cannot look upon my deafness as a serious calamity or a grave misfortune; and I dare say that an older, better, and more experienced person than I — my dear, noble mother — will share my sentiments thus expressed. She may have thought it a great calamity when I became deaf in infancy, but she would not say so to-day." I could give others of similar import, but these will suffice to show that there is manly, self-reliant spirit in many of the deaf to a greater degree than some may have credited them with. I did not expect that any whose capital mainly consists of "grave misfortune" to work upon the sympathy of others, and many who have been educated to view themselves as specially unfortunate, would at once coincide with my view. I suppose that some think, as it seems Dr. Bell does, that most if not all of the deaf will cling to the idea, "I am a poor unfortunate deaf-mute; somebody will take care of me" I fancy that I have had more experience along the line of urging the deaf to self-reliance than some who write very glibly about "a very great calamity" and "a grave misfortune." If Dr. Gallaudet and Dr. Bell would get down from their high horses, and labor for a few years in daily intercourse with all classes and grades of deaf-mutes, possibly they might have a better appreciation of some difficulties encountered by the workers among the dull as well as the bright.

With reference to "the calamity of having a deaf and dumb child," having so often heard the tale of sorrow (unnecessary, as I believe, but nevertheless real) of parents, I do not wish to speak further than to say that with Gen. Benjamin F. Butler declaring the deaf-mute is only half a man; President Edward M. Gallaudet proclaiming deafness, always in spite of school and college education, a grave misfortune; and Dr. Alexander Graham Bell understood to be advocating measures looking to the elimination of the deaf from society,— it is no wonder that the iron enters the soul of the parent of such a child, and that he is filled with disappointment, and (I blush to write it) sometimes, as I have known, with shame. That deafness is primarily a calamity, I distinctly asserted in my article in *Science*, Oct. 31; but I am happy to know that educational skill and energy in the evening of the nineteenth century is abreast with human progress in other lines, and has immensely mitigated the misfortunes flesh is heir to, so that we are not obliged to hold on to the nomenclature of a by-gone age when we speak of the deaf, any more than we are to repudiate the railroad, the telegraph, the telephone, and cling to the old stage-coach and post-boy. No one can contemplate the present state of society without feelings of pride and gratification on many accounts, but to my mind there is no more powerful exponent of the advanced civilization of this age than is found in its educational and humanitarian measures. The education of the deaf is by no means the least of these. Indeed, it may well lay claim to the pre-eminence. Out of it have come some of the best methods of teaching that have been ingrafted upon the public-school system. It was the first of all the great humanitarian enterprises, and opened the way in the hearts of the people for that philanthropy that has reached the insane, the blind, the feeble-minded, and, it is hoped, will soon reach the epileptic. No one can too highly appreciate the change in the condition of the deaf. Others may think differently, and accordingly estimate their work. They are welcome to all the comfort resulting from their view, but I thus estimate my work. It is poor comfort to a parent to be told, that, after all that can possibly be done for his deaf child, his misfortune will be a grave misfortune still. Deliver me from further lacerating the heart already torn. It suits me far better to send a beam of hope and light into a family already invaded by foreboding, than gloom and despondency.

There is at this writing before me a letter from the mother of two deaf persons, now well settled in life, in which she says to the daughter, speaking of their early childhood and their deafness, "I thought it was an awful calamity, but I do not think so now; but, as Dr. Gillett says, in many cases I believe it has proved a blessing." This mother knows

whereof she affirms, for she has other children, now also in adult life, who hear. I sometimes wonder what must be the feelings of a refined, sensitive nature as he sees his class so unjustly represented, as if doomed to perpetual childhood, or as one without whom the world would be better off. I imagine him soliloquizing, "What kind of a being am I? The Scripture speaks of persons 'of whom the world was not worthy;' but mine is a class of persons whom some seem to deem unworthy to live, and Providence has made a mistake in giving us existence, and I will immediately set to work to help Providence do better hereafter." When criminals and paupers are exterminated, it will be time enough to take in hand honest people who are handicapped by mere physical defects. I would gladly, if I could, say to every parent that a deaf child in a family may be as cunning and lovely, and as much "a thing of beauty and a joy forever," if he is properly trained and treated, as the child who hears. Superintendents are often consulted as to the care of deaf children. Let them be careful not to make of such a consultation a quasi-coroner's inquest.

Dr. Gallaudet says the deaf will not allow me to compare their misfortune with baldness. If I have done the deaf any discourtesy by the allusion, which was not a comparison of the extent of their inconvenience, but was merely a citation of a class of persons who have a physical defect, I am willing to make due apology. Far be it from me to speak disrespectfully of the bald, whom I have held in the highest reverence since, when a child, I heard the story of the naughty boys, the bald-headed man, and the bears. I apprehended, when I made the allusion, that I should hear the growl of bears, but I did not expect that the first one would come prancing out of the office of a college president. Dr. Bell is disturbed by the qualification "in fly-time." I am willing to withdraw the "in fly-time," and leave the statement without qualification; for I believe that more suffering has resulted from insufficient head-covering in the way of catarrh, resulting in phthisis, pneumonia, la grippe, etc., than from deafness. Dr. Bell counts the cost of the deaf-mute to society; but what immense outlay has ensued from the above diseases in the way of medical attendance and supplies, and nursing, to say nothing of disorganized families, mourning and funeral expenses! Would that some scientist would organize a crusade against the intermarriage of the bald, for baldness is surely hereditary. A bald variety of the human race would be dreadful.

There is another fruitful field of benevolence open to an apostle of altruism. Carious teeth are an hereditary physical defect that has cost many times more suffering and financial outlay than deafness. Let some one anxious for the comfort of future generations expend a little energy here. I see no reason why, among the many sufferers from various physical defects, the deaf alone should be restricted in the exercise of preference in the most sacred of all human relations — the marriage relation — either by legal enactment or public opinion, which has almost the force of law. It is gratifying to know that Dr. Bell now distinctly avows that neither "he nor any one else proposes to inflict this cruelty" of legal enactment. I believe he never did; but the trend of much he has said has been in that direction, and his interviewers have been singularly unfortunate in misapprehending him. Others have advocated it, and have fortified their position by quoting statements of Dr. Bell. Dr. Bell has the tender, sympathetic heart of a humane man, and a sincere interest in the deaf, and would not intentionally wound one of them; but I am persuaded that he has caused pain that he little thought of, both to the deaf and to their relatives and friends.

Many years before Dr. Bell appeared on the arena of deaf-mute work there was in the minds of many people a prejudice against the marriage of parties in whom the liability to produce deaf offspring existed. Thirty-two years ago, being with a party of deaf-mutes in an important city of northern Illinois, I remember a prominent gentleman in active business inveighing against such persons. In vain I endeavored to show him the mistake of his view. Within the last year the same gentleman and his wife have visited me with reference to receiving as a pupil his grandson, who is now one of my pupils. Comment is unnecessary. Twenty years ago a gentleman (*sic*), overlooking a company of my pupils, after asking a number of questions, said, "Every one of their parents ought to be in the penitentiary." Such sentiments are the result of intellectual confusion. Would it not be better for scientific men who have correct information to enlighten rather than confuse the public?

Dr. Gallaudet and Dr. Bell object to my "wholesale encouragement of the intermarriage of the deaf;" one advising the marriage of the deaf with hearing persons as the ideal marriage, and the other of the congenital with the non-congenital deaf. If I have done this, I have found no reason to regret it, for there have been within my observation more deaf offspring from each of the last two classes than from the intermarriage of the congenitally deaf. My advice to them is to contract marriage just as others do, with whomsoever they find that compatibility that insures a happy marriage, as a truly felicitous union is not chiefly dependent on physical conditions, insisting only that they be sure of a competence which will insure comfort. I think the most important caution for them is to beware of undue haste. One of their inalienable rights, as of others, is the pursuit of happiness; and I know of no better way of its pursuit than in a congenial conjugal relation. I should expect, as Dr. Bell does, a larger percentage of deaf births from deaf parentage than exists in society at large; but this is not because the parents are deaf, but because they belong to families in which the tendency to deafness inheres, other members of which are as likely to have deaf offspring as the deaf themselves, and who in fact do more frequently have such children, as is shown by the far greater number of other relationships to the deaf than of parent and child. If it is improper for the deaf to marry, it is as much so for their relatives to enter wedlock. In the year 1886 I made a computation of the deaf relationships to my then present and former pupils, numbering 1,886, which showed, that, while thirteen of them had deaf parents (the parents of only one were congenitally deaf), there were 1,209 other relationships, as brothers, sisters, uncles, aunts, cousins, etc.

I am sorry that Dr. Bell (*Science*, Dec. 26) considers this question from the low plane of mercenary considerations. "Two hundred dollars a head" seems to him a terrible outlay for the deaf, while the *per capita* for hearing persons is but twenty dollars *per annum*. There is a glaring fallacy in this comparison. The two hundred dollars charged to the deaf pays for his entire instruction and support, which is done for his hearing fellows in the home, the church, the school, the mart, the shop, the social circle, the lecture, and on the play-ground. Will Dr. Bell say that all this costs the hearing youth only twenty dollars a year? I trow not. If he thinks it will, let him ask some patrons of Vassar, Wellesley, the Pennsylvania Training School, or Mount Vernon Seminary, near his home, or any other re-

spectable academy where youth are entertained and educated, and this illusion will soon be dispelled. Why one who insists that the deaf are laboring under a "very great calamity" should so unfairly misrepresent their case seems to "unreflective minds" incomprehensible. It is no answer to say that all the hearing lad receives is paid for by his friends, while the public pays for what the deaf receive, since the accumulations of the rich are all received from the public; so that whether paid for directly by the public, or through the circuition of private intermediaries, it all comes out of the public.

Dr. Bell's figuring in the same number of *Science* is a most surprising feat of mathematical gymnastics. I should be sorry to think that all of his calculations and conclusions were as baseless as this. Quoting my statement that "not two per cent of the deaf are children of deaf parents," he immediately proceeds to speak of "Dr. Gillett's two per cent," and represents me as affirming what I explicitly denied. He might as well have figured on five or ten or twenty per cent, so far as any thing I have said is concerned, and would have evolved a much more imposing Jack o' lantern. Having a false premise, his calculations are worthless even if amusing. Unfortunately, many persons seeing them over his great name will be deceived by them.

I have never named any percentage of deaf offspring from deaf parentage. I do not know what it is. My observation is too limited. I doubt if any one knows. But I am quite sure that the marriage of a few congenital deaf-mutes "with one another" is not going to inoculate the whole world with the "very great calamity" of deafness. If he deserts the question as a practical one, and treats it merely as an interesting question of scientific inquiry upon heredity, I have comparatively little interest in it. It interests me chiefly as a practical question. As such I have given it some attention for a number of years. I can only study it in the light of the facts I have, which are almost wholly among my own pupils. I think it quite probable that different conclusions would be arrived at from the study of pupils in other institutions, and that probably they would agree in no two or three groups of deaf-mutes, or of pupils of the same institution in different decades and quarter-centuries, owing to the prevalence of different diseases that cause deafness, and the variance in their virulence at different times.

Dr. Bell repeats my interrogatory, "Shut out from church privileges, as preaching of the Word, prayer-meetings, socials, receptions, lectures, concerts, parties, what remains to them of all that makes life pleasurable to us?" The question is easy of answer. There is open to them a world of beauty and grandeur, full of fragrance and loveliness, the treasures of literature and art, which they may appreciate as highly, and enjoy as intensely, as those who hear.

> "Sermons in stones,
> Books in running brooks,
> And good in every thing."

There are many needy and distressed to whom they can minister, receiving therefrom the highest satisfaction known to mortal man. Most of that which makes life noble and worth living is still attainable to them, if they improve their opportunities.

I regret that my knowledge of the past school-life of my pupils is not more complete than it is, and also that in my earlier experience I did not secure more exact statistics. Sometimes it is extremely difficult to obtain the precise information desired. Occasionally positive refusals to give it are encountered. The vital statistics gathered at institutions for the deaf are usually taken from an educational standpoint, and consequently some deaf children who lost hearing very young are classed and recorded as congenitally deaf. For educational purposes this classification is very well; but for biological and anthropological study such statistics are defective, and cause confusion. For the study of heredity they are misleading. I am persuaded that we are far from having an accurate knowledge of some of the primal causes of deafness. One quite prolific cause has been entirely overlooked, owing to the delicacy of the subject, and the difficulty of acquiring correct information in such cases. It could be appropriately discussed in a medical journal, but in a popular periodical its consideration may not be acceptable.

The cause to which I refer is psychological, and the mode of its operation is obscure. Just how mind or spirit operates on matter we do not know, but the fact is undeniable. I am quite positive, from knowledge obtained during a long period of years, that prenatal impressions are responsible for many cases of deafness which have been attributed to other causes, including heredity and family predisposition. Within my observation there have been more cases of deafness from this cause than of deaf offspring from deaf parentage.

Dr Bell inquires with reference to certain statistics I published five years ago. I am bound to admit, that, while at the time I thought them approximately correct, I have since gained additional information that somewhat changes conclusions from their study. I have had 2,158 pupils, of whom 1,580 have been discharged from the institution. No doubt a considerable number of these have contracted marriages of which I have not received information, but I have learned of the marriage of 378 of them. They were parties to 233 marriages.

Thirty-three married hearing partners. Of these, seven were congenitally deaf. Of thirty-two of these thirty-three couples, all the children could hear. Of one of these couples, the mother being congenitally deaf, two children could hear and two were born deaf.

Of thirteen couples, both parties were congenitally deaf. Of twelve of these couples, all the children could hear. Of one of these couples, two children could hear and one was born deaf.

Of fifty-one couples, one party was congenitally deaf, and one was adventitiously deaf. Of these fifty-one couples, one couple had one hearing and four adventitiously deaf children; one couple had one hearing and one adventitiously deaf child; three couples had one congenitally deaf child; one couple had two congenitally deaf children.

Of twenty-five couples, both parties were adventitiously deaf. Of twenty-three of these couples, all the children could hear; of one of these couples, one child could hear and one is congenitally deaf; of one of these couples, four children hear and one is adventitiously deaf.

But I have had other pupils whose parents, though deaf, were educated elsewhere. Two sisters born deaf were children of a deaf father and hearing mother. Two brothers — one congenitally and one adventitiously deaf — were the children of deaf parents; but whether the parents were congenitally or adventitiously deaf, I have been unable to learn. One boy was adventitiously deaf whose father was deaf, but of whose mother I have no information.

The foregoing may be tabulated as follows: —

Parents.	Offspring.	
	Congenitally Deaf.	Adventitiously Deaf.
Both parents congenitally deaf.....	1	
One parent congenitally and one adventitiously deaf....................	5	5
One parent adventitiously deaf, one hearing..........................	2	
Both parents adventitiously deaf.......	1	1
One parent hearing and one congenitally deaf.............................	2	
Both parents deaf, but whether congenitally or non-congenitally unknown.	1	1
Father deaf, but whether congenitally unknown, but of mother no knowledge.............................		1

Applying the above to the classification recommended by Dr Bell and approved by Dr. Gallaudet (*Science*, Nov. 28, 1890, p. 295), while it is difficult to decide as to which class some of them should be assigned, I should say that it appears as follows: in Class 1, two; in Class 2, twelve; in Class 3, five; and in Class 4, one.

Let the reader consider the above table, which comprises twenty deaf-mutes, three of whom were never among my pupils (thus leaving seventeen), and remember that it shows the deaf parentage of 2,158 deaf-mutes, and observe that only one of them is the child of parents both of whom were congenitally deaf, that ten are the children of parents one congenitally and one adventitiously deaf, and two the children of one hearing and one congenitally deaf parent, and ask who is advising the promotion of "a deaf variety of the human race." It is not the subscriber. I find no two per cent in this.

"Master, who did sin, this man, or his parents, that he was born" deaf? "Jesus answered, Neither has this man sinned nor his parents." Philip G. Gillett.

INDIAN PRESERVES.[1]

The demand for Indian preserves and jams has greatly increased during the past few years. In India, preserves and jellies are made of the pear, quince, mango, tamarind, date, banana, guava, and other fruits. In Singapore, pineapples are preserved whole; and in the Bahamas the manufacture is also carried on, on a large scale, to the extent of nearly 1,000,000 cans annually. Each can of fruit, before the sirup is added, weighs two pounds. From 12,000 to 14,000 can be filled in a day; and 25,000 pines are usually consumed daily during the season. In Singapore much enterprise has been shown in preserving tropical fruits. There are two or three firms who deal largely in them.

The Indian preserves were formerly much in request. Thus, in the thirteenth century the most renowned preserve was a paste made of candied ginger. Among other fruits, etc., preserved in their natural state, in sirup, crystallized with sugar, or made into jelly, are the pineapple, bread-fruit, ginger, jack-fruit, the papaw, mangosteen, pomeloe, guava, and nutmeg. Although in flavor and preparation these preserves may not equal those of Europe, they make an agreeable change.

The pineapple is one of the best of tropical fruits, although it is produced of a superior quality by European cultivators. Its sweet and acid flavor, and pleasant aroma, make it sought after by consumers of all classes. One house in Singapore ships about 70,000 tins of this fruit. Pineapple marmalade (thought by some to be the most delicious preserve in the world) might also be sold at ten cents per pound in London.

There are two species of guava fruit — the red guava; and the white, or Peruvian, guava. Both make excellent sweetmeat paste or jelly, which is very pleasant and nutritious, from its superior power of assimilation with the gastric juice, and perfect development of saccharine.

It is said that a hundred different preserves could be made from a judicious blending of the fruits of the East and West Indies and South America.

The jamun (*Syzygium jambolanum*), a sort of long, dark purple plum the size of a large date, makes excellent preserves, and has exactly the flavor of black-currant jelly, to simulate which large quantities are sent from India to England. It is also used for flavoring other jams.

The fruits of *Inocarpus edulis* are preserved in the Indian Archipelago. A sweet conserve is made in India of the fruits of *Terminalia Chebula*. Another is made of the fruits of *Phyllanthus distichus*, at Birbhum in Bengal. The acid calyces of the rosella (*Hibiscus sabdariffa*) are converted into an excellent jelly, which would be highly appreciated in England, if once introduced. Jam and jelly are made in Canada from the fruit of *Shepherdia argentea*.

The fruit of *Spondias*, not unlike a cherry, is made into jelly. The scarlet fruit of the quandong (*Fusanus acuminatus*), the size of a small peach, makes an excellent preserve for tarts in Australia.

The tamarind plum (*Dialium indum*) of Java has a pod filled with a delicate, agreeable pulp, much less acid than the tamarind. The golden drupes of *Spondias cytherea*, or *dulcis*, a native of the Society Islands, are compared, for flavor and fragrance, to the pineapple. The large acid fruits of the kai apple (*Aberia caffra*) of Natal can be converted into a good preserve of the red-currant jelly class. The fruit of *Cornea speciosa* is delicious: it is called "mangaba" by the Brazilians, and when ripe is brought in great quantities to Pernambuco for sale.

The fruit of the goumi, of Japan (*Elæagnus edulis*), makes excellent preserves, fruit sirups, and tarts. The berries of *Pyrus aucuparia* and of *P. baccata* are made into comfits, conserves, and *compôtes*. The fruits of *Astrocarpum ayri*, of Brazil, are made into an excellent preserve, which is much esteemed in that country.

The fruit of the Chinese quince (*Diospyros amara*) is converted into sweetmeats, of which the Chinese are exceedingly fond.

The bread-fruit, in sirup or crystallized, may please native palates, but it is not likely to find favor in Europe, being flavorless, and more of a food-substance than a fruit.

Preserved ginger is popular in England, but is not much esteemed on the continent. The Spaniards eat raw ginger in the morning, to give them an appetite; and it is used at table fresh or candied. Among sailors it is considered antiscorbutic. The quantity of preserved ginger imported ranges annually from 1,500 to 2,500 hundredweight, value about $17,500 to $21,500. It forms the bulk of the succades received from the Chinese Empire, 18,000 to 20,000 hundredweight coming from Hong-Kong. Some ginger is also received from India. The mode of preparing it in the East is as follows: The racemes are steeped in vats of water for four days, changing the water once. After being taken out, spread on a table, and well pricked or pierced with bodkins, they are boiled in a copper caldron. They are then steeped for two days and nights in a vat with a mixture of water and rice-flour. After this they are washed with a solution of shell lime in a trough, then boiled with an equal weight of sugar, and a little white of egg is added to clarify. The ginger, candied or dried in sugar, is shipped in small squares of zinc. That preserved in sirup is sent out in jars of glazed porcelain of six and three pounds, and packed in cases of six jars. The quality called "mandarin" is put up in barrels.

The papaw (*Carica papaya*) is a fleshy, pulpy fruit, of an orange color, sweet and refreshing, which is eaten as the melon is in Europe. This fruit, however, in sirup or crystallized, has very much the taste of a turnip.

The mangosteen is a fruit about the size of a mandarin orange,

[1] From the Journal of the Society of Arts, London.

of a sweet flavor, accompanied with a slight acidity, and an odor resembling the raspberry. It is the produce of *Garcinia mangostana*, and is one of the most delicious and famous of the fruits of the Indian Archipelago, ranking with the pineapple. Presents of baskets of it are sent from Singapore to India and China. It is a pleasant fruit, with a delicate but characteristic flavor, partaking of the strawberry, grape, pineapple, and peach. The happy mixture of tart and sweet in the pulp renders it no less salutary than pleasant; and it is the only fruit which sick people are allowed to eat without scruple. In Cochin China they sell at from a dollar to a dollar and a quarter the hundred.

The pomalo (*Citrus decumana*) is a large fruit of the orange family, with an acid flavor, frequently bitter. The pulp and thick rind, crystallized with sugar, are eatable, but lose much of their natural flavor. It it better known as the shaddock, and the fruit will exceptionally attain a weight of twenty pounds.

The mammea apple (*Mammea Americana*) is abundant in the West Indies. The pulp is of a sweet aromatic smell, and of a peculiar yet delicious flavor. It is sometimes sliced, and eaten with sugar or wine, and also makes a very good jam by being preserved in sugar. Another tropical fruit, the *Mammea sapota*, is known as American marmalade, from the similarity of the flavor of the pulp to the marmalade made from quinces.

The succulent fruits of *Cicca disticha* have an acid, sweet flavor, and are eaten cooked or made into preserve.

The green, fleshy, gratefully acid fruits of *Averrhou bilimbe* and *A. carambola* are preserved, and used for tarts and for flavoring various dishes.

An excellent preserve is made from the sweet peel and acid pulp of the comquat or kumquat (*Citrus japonica*), a curious, small, nutmeg-shaped orange in China and Japan.

The red berries of *Carissa carandas* furnish a well-known substitute for red-currant jelly, in India and China.

The Peruvian cherimoyer (*Anona cherimolia*) is a highly esteemed succulent fruit, of a most luscious flavor, containing a soft, sweet mucilage resembling strawberries and cream. It is often called the "queen of fruits."

The mango, the mangosteen, the custard-apple, and the durian are known by repute only to the people of this country; but, while they might easily be frozen and brought here in admirable condition,—dishes fit for the gods,—no attempt is made to utilize these luscious fruits of India in their fresh state, nor is very much done in preserving them.

The durian (*Durio zibethinus*), although it has a strong offensive smell, is eaten greedily by the Burmese, and as many as 40,000 are annually sent to Upper Burmah.

The mango (*Mangifera indica*) is the best fruit in India, as highly valued as the peach with us, and forms a considerable portion of the food of large classes of the native inhabitants. The varieties cultivated are about as numerous as are those of the apple. An Indian gentleman has made colored illustrations of more than two hundred varieties of this fruit. The quality is difficult to judge of from external appearance. There are large and small, elongated and abbreviated, bright orange-colored and green. They vary much in taste, some being of the flavor of honey, some of pineapple, some of orange, while others have distinct flavors of their own. A good mango should be as little stringy as possible, and should not have too much of the turpentine flavor towards where it is attached to the foot-stalk: a moderately aromatic savor there is by no means objectionable.

The young unripe fruits are largely consumed in India in tarts, etc., and mango-fool there takes the place of gooseberry-fool. The half-ripe fruits are also made into a marmalade which resembles much that of apples.

So large is the consumption of this fruit in India, that wagonloads, bringing collectively twenty tons of the fruit, have entered the Island of Bombay in a single day. The fruit of the finest mangoes have a rich, sweet-perfumed flavor, accompanied by a grateful acidity.

The thick juice is by the natives of India squeezed out, spread on plates, and allowed to dry, in order to form the thin cakes known as amsatta. The green fruit is sliced and cooked in curry; is made into pickle with salt, mustard, oil, and chillies; and also into preserves and jams by being boiled and cooked in sirup. Some varieties of mango have fruits as big as an infant's head, ovate, with a golden skin, speckled with carmine, and a greengage flavor.

The finest varieties of this almost unequalled fruit seem to thrive in Jamaica, where it was introduced about a century ago as well as in Bombay. It is the popular fruit there with the negroes.

The Siam mango is a tolerable kind, which sometimes grows to one pound weight. The egg-mango is a small, yellow kind, with too much of the turpentine-flavor, and too acidulous to be much prized. The horse-mango is a very coarse fruit of unpleasant odor, much eaten by the lower classes, and producing cholera, diarrhœa, and dysentery. The Bombay mango, termed "Parsee," is known for its lusciousness and delicacy of flavor, the absence of fibre, firmness of flesh, thinness of skin, and small size of the stone. It must, however, be admitted that on tasting this delicious fruit for the first time, a slight turpentine flavor is experienced.

A raw guava, or even a raw mango, may not be, to every Englishman's palate, a satisfactory exchange for a mellow pear or a juicy peach, but preserved mango and guava jelly are things by no means to be despised. Some of these preserved foreign fruits are delicacies only to be obtained at some of the best West-end houses, at prices too high for ordinary consumers; but if large quantities were sent into the market, and the prices consequently lowered, the demand would become greater, and the sale more profitable, and would probably lead to the introduction of new articles, to the mutual benefit both of ourselves and the growers and preservers of the fruits.

Mango jam is prepared by boiling the mango in sirup, after removing the skins and stones, and the sour juice squeezed out by the free use of forks, and soaking in fresh water. Two pounds of mango to one ponnd of sugar is the proportion in which it is prepared.

Bilimbi jam is made by removing nearly three-fourths of the juice of the fruits of *Averthoa bilimbi*, and soaking in water, squeezing the fruit and boiling them in sirup. Nelli jam, from the fruit of *Phyllanthus embelica*, is made in the same manner, proportion of fruit and sugar same as mango.

From Natal there have been shown at the various exhibitions amatungula jam, the produce of the fruit of *Arduina grandiflora*, sometimes called the Natal plum. This jam is firm, nearly like that of the quince, and has a rough acid flavor, but is a curious and agreeable preserve.

The gooseberry jelly from there is the produce of *Physalis pubescens*. It is pleasantly sharp, without having the rough, metal-like acid of the amatungula. The guava jelly has the full taste of the West-Indian preserve. The pineapple jam has the rich, almost too luscious taste for which the Natal pines are famed. The loquat is a very sweet and fine preserve, slightly resembling quince marmalade, but with less pronounced individual flavor. The fruit is very delicious in its unpreserved ripe state, having the flavor of an apple grafted upon the flesh of the melting peach, with large apple-pips taking the place of the stone, and ripening in massive bunches. Like the peach, the fruit is almost too delicate for a preserve. Its most refined and exquisite qualities do not survive the bath of boiling sugar. The rosella is the preserved fruits or calyces of the *Hibiscus sabdariffa*, which makes a most estimable substitute for red-currant jelly, particularly relished in hot climates. The grenadilla, the purple fruit of a passion-flower (*Passiflora edulis*), is almost without a rival for delicate fragrance and perfume, has a sweetish acid taste, and makes an excellent preserve. The St. Helena peach resembles, in the preserved state, a very excellent yellow plum. The shaddock marmalade might also be spoken of as a worthy substitute for the Seville orange marmalade.

Nature says that the Russian painter Krilof is painting the portraits of typical representatives of the various races included in the Russian Empire. In carrying out his purpose, he has undertaken many long journeys; and he has now a small gallery which ought to be of considerable value from an anthropological as well as from an artistic point of view.

SCIENCE:

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Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer: not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

A BOSTON "ZOO."[1]

IT is a little strange that a zoölogical garden should be so rare a sight in our country, or, if found, should be so poorly equipped, when there is hardly a European city of any size without one, which is invariably a centre of attraction for all American visitors. We often hear the inquiry, "Why cannot we, too, have a 'zoo'?" and we all know that such a garden in Boston has long been talked of. Indeed, it has been seriously studied for a number of years by our naturalists; but a brief consideration will show that to found and sustain an establishment of the first class, modelled on the best in Europe, would involve an expense very much greater than there, simply from the fact that in no place in Europe where a flourishing and extensive garden exists, are the winters nearly so long or so severe, nor are they accompanied by such abrupt terminations, as here: our winters, in short, would entail a vastly increased expense to keep tropical creatures in health, and presentable to the visitor.

But this is by no means the only difficulty we labor under in Boston: for two things are absolutely essential to an undertaking of this sort, — first, sufficient space; and, second, its accessibility to the public. Now, where are we to look for an unencumbered spot of ground sufficiently extensive for these purposes reasonably near the heart of our city?

The acreage of the gardens in Europe ranges from about half a dozen to half a hundred acres, but hardly one of them has room enough for its animals. The Zoölogical Garden of London, the best and most successful of all, is very crowded, and does not appear to cover more than thirty-five acres, so far as can be told by measurement from a map. Forty acres — somewhat less than Boston Common — is the least we ought to count on here; but we have barely saved for ourselves on the outskirts of the city room for public parks.

The "scientific" and the "practical" man are often set in antithesis. Will you kindly give your attention for a few minutes while I endeavor to show that they may also be named synthetically, by pointing out how the scientific men try to answer a practical question and resolve practical difficulties?

We who have had this matter before us have been on the watch for opportunities long enough to see an immense growth in our city and a rapid occupation of our suburbs. We have seen one spot after another which we had looked upon with envious eyes fall into the hands of the land speculator, until the chances seemed to grow less as the needs appeared greater. But our opportunity at last came with the establishment of the Park Commission, without whose hearty support we should be silent to-night.

The only piece of ground under the control of the park commissioners large enough to have a portion of it set apart for a general zoölogical garden is Franklin Park in the Jamaica Plain district: but there are two insuperable objections to the use of this cite, — first, that it contains no sufficient body of running water for the needs of aquatic animals; and, second, that the segregation of a sufficient territory would absolutely prevent the use of this large section as a country park, one of the most important of the designs of the commissioners, and not elsewhere attainable. The only possible escape from this dilemma is one which, while it certainly involves an additional expense, brings with it compensating advantages. It is the division of the proposed Natural History Gardens into separated sections. The disadvantages of this plan are the extra expense of fencing, and of gate-keepers and superintendence, and that we should have to go to widely distant points to see all that there is to be seen. The advantages are the better selection of sites for special groups of animals, and the important fact that some one of the exhibits would be easily accessible to every inhabitant of the city.

For the purposes of a natural-history garden,— we use this word as more correct than the more limited but more usual one of zoölogical garden,— animals and plants may be divided into those inhabiting the salt water or dependent upon it for means of sustenance, those inhabiting the fresh water or so dependent, and land animals properly speaking. All air animals would find food and shelter within or upon one or other of these media, and therefore we need not consider them as a group apart. One grand factor in life here presents itself, by taking advantage of which we may impress it upon every visitor to our gardens by compelling him, if he would learn all we offer, to pass at some expense of time and labor from one of our exhibits to another. It is our first essay in teaching one of the fundamental facts of nature.

The sympathetic concurrence of the park commissioners enables us to carry out, it has indeed originated, this idea, since they offer us three separate tracts,— one upon the seashore, one which includes a pond of moderate extent and the valley of a small stream, and the third a very attractive bit of rocky woodland and glade. Not one of these spots is all that could be desired for the purposes in view, but they are the very best the park commissioners have to offer; they are the best unoccupied grounds left about Boston; and they cover the two requisites mentioned at the start,— suitable room and sufficient for all reasonable purposes, within easy reach of the people.

Observe for a moment their position on this map of Boston. The Marine Garden, or Marine Aquarium, as we call it, will be situated at that point where Boston stretches its farthest hand to the sea, in the so-called Marine Park, already in its half-finished state thronged by thousands, especially in the summer, and which is more easily reached than

[1] Remarks made at a meeting of the Thursday Club, Boston, Jan. 15, by Samuel H. Scudder.

most of us imagine by the horse-car, soon, no doubt, to be supplanted by the electric railway.

Diametrically opposite, in the near suburbs, is Jamaica Pond. The park grounds almost touch its northern margin; and separated from it only by the highway and the steep banks on either side is Ward's Pond, well known to skaters, and the head waters of a stream with the uninviting name of Muddy River. It is close to the heart of Brookline, Boylston, and Jamaica Plain, and here it is proposed to plant the Fresh Water Aquarium.

Also near to Jamaica Plain, and barely at the outer edge of the multiplying streets and thickly settled districts, on the city side of Franklin Park, reached from the heart of the city itself by two lines of electric cars and one line of steam-cars, hardly more than across the road from one of Boston's crowded resorts for pleasure, is the third reservation, the largest tract of all, known as the Long Crouch Woods, destined for the display of land animals.

But now we meet one of the necessary limitations already alluded to. Marine and fresh-water animals are usually exhibited in series of aquaria and tanks in buildings, which manifestly need but little space. Land animals, on the contrary, especially the larger sort, require a great deal of room; and just here comes in the question of the housing and proper exhibition of tropical beasts. We do not wish to show them in cages, as in a stranded circus. Whatever is exhibited should be shown in circumstances and amid surroundings as nearly natural as possible, and cleanliness is an important condition.

Now, the space at command at this end of Franklin Park — about twenty acres — will in no way permit the suitable and satisfactory display of the numerous hordes of tropical animals; and the enormous expense attendant upon their winter housing in such a climate as ours altogether forbids such an undertaking now; our people are not yet eager enough for such shows to give them financial support; it may be that by and by we shall find that our present plan has outgrown our most sanguine expectations, and be able to secure some cheap waste land not far removed (say the salt marshes north or south of Boston), on which such a general garden could be built up by slow degrees. Such a scheme we may leave to those who come after us. For us, we must dismiss such fond dreams as immediately chimerical, and ask ourselves what we *may* have, what limits we should assign ourselves and yet be satisfied.

When we remember that not one in ten thousand, perhaps not one in fifty thousand, of our city people (not only here in Boston, but anywhere), has ever seen or is in any way familiar with the greater part of the animals and plants that are indigenous to the soil on which he was born and bred; when we further notice, what I believe is the fact, that not a single collection of living animals in the world has ever been made, either separately or in connection with a larger display, to show the native animals of the region where they are exhibited, although natural-history museums of dead nature very often offer this attraction, — we see at once that we have here an opportunity of setting an example to the world, sure to be followed, to the gain of general education everywhere. The advantages and the interest of such an exhibition are plain; more than that, these creatures are the very ones which need least protection and expense, so that the plan is doubly feasible. The only question is, How wide a scope shall we give to the term "indigenous"? What territory shall we draw upon? This we may well leave to future experiment, but we should wish at least to show the animals and plants of a zone across our continent within the latitude of New England. The New England indigenes would then always form the bulk of the collection, and we should have in fact, as well as in name, a New England garden. This fact, this name, would have its value and its significance; and elephants and giraffes, camels and tigers, would not be expected, and the travelling menagerie and the Fall of Babylon be deprived of no monopoly.

The garden thus becomes educational: it teaches as a whole the lesson of our surroundings; it impresses the fact that the range of animals is circumscribed within definite areas, however large. It *should* teach more: it should give some hint, at least, of a wider outlook; it should show how, as we pass beyond the range of our own indigenes, these are replaced by others; it should hint how far we need to go to find this out and the nature of the change. Side by side, then, with our native animals, if we would enlarge the horizon, must we show their kin, even if we go beyond the seas. Such a collection must be limited, to be most instructive. It is now the aim, in the best museums of natural history conducted for educational purposes, to concentrate the attention upon relatively few objects, rather than confuse the mind with the bountiful prodigality of nature. Side by side with our black and grisly bears we might show the brown bear of Europe and the polar bear, and stop there; as a companion to the opossum, we should look to the home of the marsupials and choose the kangaroo—no need of more; for our larger variety of smaller quadrupeds, our squirrels, moles, mice, and bats, and we may also say for our horned ruminants and our cats, not even so much extra-limital material would be necessary: so that, though some of the missing types should also find a place, such as a sloth, an ornithorhynchus, or a monkey, the draught on tropical animals would be exceedingly small, and need not be felt as a matter of concern.

I have instanced here only a few among the quadrupeds. There is no need of enlarging: the story would be the same with the birds, reptiles, and other animals. Such a collection would be of unique interest and attraction; its installation in Long Crouch Woods would be all that could be desired; and it would be easy to add such features to the garden as would make it equally attractive at all seasons. Thus it is not impossible that special exhibits might be made of birds of passage, during the period of their migrations. A winter garden under glass has been suggested, which might well become one of the chief resorts of the people by day or evening, where in a temperate atmosphere, with a varied and soft foliage everywhere, they would find pleasure and profit in looking at flowers and birds, fountains and brooks, and in learning the habits of curious strange creatures at their play.

If I have dwelt on this division of the Natural History Gardens longer than I should, it has been mainly to show how the very limitations to which the scheme is subject have been made to serve a useful purpose. It is not possible, however, that this part of the plan should be brought to successful issue at once. The division of the gardens allows the opening of one section at a time, — a very important consideration, — and this section, as certainly the most expensive, will of course come later. Let us, then, pass for a brief time to the neighboring department, that of the Fresh Water Aquarium at Ward's Pond.

The spot is a sheltered one, protected by encircling hills, most favorable for our purpose. Here will be relegated not only the animals and plants inhabiting fresh water, but

also those which live in or upon its banks; and as the space here seems to be ample,— the ground covers about fourteen acres,— expense would be the only limit; so that, should the returns warrant, we may eventually include not a few sub-tropical or even tropical animals. The stream will be so turned as to run in winding channels through pond-like enlargements, much increasing the opportunity for the out-door display of water-fowl and beast. Here will find their place fish-hatcheries where the processes of growth may be observed, and insectaries in which the changes which many creatures undergo in passing from an aquatic to an aerial life will be readily seen. So other significant transformations may be observed in displays which will show how readily certain brine shrimps may change their actual structure to become in a few generations fresh-water shrimps, and illustrate the rarely considered fact that all fresh-water organisms are modified descendants either of marine, or, by retrograde movement, of terrestrial, animals or plants. The broad relations of our three realms of life will thus be indicated. Here, too, will be fine opportunities for the growth of water-plants, both of the temperate zones and of the tropics; for, with proper care, even the wonderful *Victoria regia* can be grown in full beauty.

Many of these things will be seen, of course, under cover, where, in the inclement season, all creatures which live beneath the surface of the water must be housed. Houses must also be fitted for the protection as well as display of all foreign creatures, so that in winter and summer alike this section of the garden shall have its full share of attractions.

But the place of highest interest and usefulness is that which we wish first to undertake, the Marine Aquarium at City Point,— greatest, because of the larger variety of form, of structure, and of color among marine animals; because, too, some of the most beautiful and most surprising of these creatures are inhabitants of our own seas, but are almost wholly unknown except to naturalists. When the display of the animals of our own waters in all their vivid coloring, lovely or grotesque form, and varied action, is ready, thousands will marvel at the revelation of a new world of their own of which they have not dreamed.

The ground here allotted, covering about eight acres, will be ready for occupation the coming summer, and will have as its chief attraction a building for aquaria, so arranged that almost the only light which enters the halls will be that which passes through the aquaria; and we may thus watch the creatures much as if we were ourselves beneath the sea, without those features which might make such a position disagreeable. The first room to visit, however, would be one devoted to an exposition of the relations of animals and plants to their surroundings, such as would give a clew to much we should afterwards see which would be otherwise obscure. Not only would the differences between the great groups of animals and plants be made clear by proper preparations and other exhibits, but a distinct effort would here be made to show what definite relations the structure of animals bears to their immediate surroundings and to their habits, and how animals are provided with the means to do the precise work they have to perform, for work is a condition of being. The changes that have taken place in the structure of certain descendants of air-breathing land animals, such as whales, in order to fit them for marine life, would be illustrated, and other fundamental laws of organic modification would be made clear by aids known to the expert. A similar introduction would be offered in the other sections of the gardens, modified to suit the immediate situation and multiply the illustration, so that the full value of each exhibit might be attainable on the spot.

In the general exhibition-rooms the individual aquaria are like the cases in a museum: their position or their contents may be altered or shifted at will to illustrate this or that feature. But it is probable that geographical data will always have a large influence on the juxtaposition and distribution of the inhabitants of the tanks, first, because it is possible and desirable to have many sorts — widely differing sorts of animals which do not come into collision — in a single vessel, but also because of the importance which relative depth in the ocean, as well as latitude and longitude, has upon marine life. Our own marine fauna and flora would be displayed by itself in special series of aquaria; while, as every desirable range of temperature would be possible in the different tanks by simply heating or chilling the inflow, or, by convection, the water in the vessel itself, tropical and arctic animals, once obtained, could be kept throughout the year.

Outside in the grounds large and small salt-water basins are planned, within which it is hoped to confine and exhibit some of our smaller cetaceans, porpoises, dolphins, etc., as also seals; while upon their shores and islands water-fowl and other creatures would disport themselves. It may even be practicable by some device to create, in a basin of smaller extent, an artificial tide, with high water at noon and at midnight by the clock, so that the intertidal animals may find their place, the nimble "peep" scamper in flocks along the beach (their wings clipped, of course), while the margins shall represent at intervals a rocky and a sandy shore. This bit of marine life transplanted to our homes need not end here: we should reproduce also the vegetation of the immediate coast; even the beach-grass of New England may find its corner and give its lesson, offering shelter and congenial home to the maritime locust, whose complete protection through its colorational resemblance to the sand it dwells upon would give to every one who sought it out a practical lesson in one of Nature's most hidden laws,— the importance of disguise and mimicry.

The finest existing zoölogical garden is controlled by a strictly scientific association, — the Zoölogical Society of London. It remains to be seen whether our Society of Natural History cannot accomplish in America a similar work. We may not be able to rival our transatlantic brethren in the extent of our menagerie,— here we are handicapped by the lack of colonial possessions,— but the wide extent of our country gives us altogether the advantage in a display of native animals; and, if we rightly seize the opportunity before us, we may have a series of gardens second in educational value and in public interest to none in the world.

MEN WHO ARE WORKING WITH KOCH.

PROFESSOR KARL FRAENKEL, whose highly important experiments with a view to conferring immunity against diphtheria are now one of the chief topics of discussion in the medical world, is a pupil of Robert Koch. According to the *Lancet*, he passed his final examination as a physician in 1885, was appointed assistant in the Hygienic Institute, Berlin, on its establishment, and soon became Koch's first assistant there. In 1837 he established himself as private lecturer in Berlin University. About a year ago he was appointed professor of hygiene at Königsberg. He became generally known in medical circles by the publication of his "Elements of Bacteriology," in 1886. This book has appeared in a third edition, and has the reputation of being the best of its kind. The most important of Fraenkel's special in-

vestigations are those of bacterial poisons, which he made in common with Ludwig Brieger. They led to the discovery of toxalbumin. and to that above mentioned. His other discoveries are those concerning the bacterial contents of ice, the cultivation of bacteria which thrive without air, the occurrence of micro-organisms in the various layers of the soil, etc.

Dr. Kitasato. a Japanese by birth, has lived in Germany for five years, and has occupied himself almost all the time with bacteriological studies in the Hygienic Institute. The biology of the cholera bacillus has been the theme of many of his researches. He has investigated its behavior in milk and in fæces, and its relations to other pathogenic and non-pathogenic bacteria in nutritive solutions. He has also gone deeply into the study of the tetanus germs, and has now published the results of his investigations in his article on immunity. One of his chief discoveries is that of the musk fungus.

Dr. Ernst Behring, who has shown, in conjunction with Dr. Kitasato, how immunity against diphtheria and tetanus is conferred on animals, is an army surgeon, and has been working as an assistant for about a year and a half past in the Hygienic Institute. Among his first studies after he became a surgeon, ten years ago, was the manner in which antiseptic remedies for wounds, especially iodoform, act, and he made a special study of the symptoms of iodoform poisoning. He afterward tested the antiseptic value of silver solutions, creoline, and other chemicals. Cadaverine, the etiology of anthrax, and the immunity of rats, are also among the themes to which he has devoted special attention, but diphtheria has recently been his exclusive study.

HEALTH MATTERS.

Action of Living Blood on Bacteria.

PROFESSOR BONOME has recorded the results of his researches on the following points: whether physiological alterations in the blood play any part in modifying its destructive action on bacteria; whether it is possible to produce alterations in the composition of the blood of such a nature that the normal inimical action against bacteria may be altered; and whether it is possible to derive any reliable data that will throw light on the subject of immunity. As a result of his experiments, he comes to the conclusion that staphylococci introduced directly into the blood are destroyed in from ten to twenty-five minutes, more rapidly in the blood of young rabbits than in older animals of the same species (*British Medical Journal*). He then, by injecting the poison obtained from the pus of an old empyema or a chronic abscess in small quantities into healthy rabbits, proved that the bacteria-destroying activity of the blood is increased, the organisms used being staphylococcus aureus, albus, and citreus. He holds, however, that the introduction of such poison does not appear to exert any influence upon the similar activity of the fixed tissues. Poison from acute pus obtained in a similar manner appears to exert not the slightest influence on the destructive action of the blood; while, owing to its effect upon the tissue-elements, it diminishes their power of destroying such organisms as the staphylococci above mentioned. Similar poison from pyogenic staphylococcus culture does not increase this destructive power of the blood against the above-mentioned organisms; and any immunity that is produced depends, not on the rapidity and certainty with which the blood destroys the organisms introduced into its stream, but rather upon a greater resistance which the tissue-elements exert against the bacteria poison, when they have become accustomed to the action of the poison by remaining in contact with the metabolic products of the same bacteria. He also gives experiments to show that water injected into the veins can diminish this destructive activity of the blood to a certain extent, but never completely; for although the animals so injected, and control animals, died about the same time, those in which water had been injected usually showed small purulent deposits in the kidneys and myocardium, and more or less fatty degeneration of the epithelium of the kidneys: so that he considers, that, in addition to this slight diminution in the destructive activity of the blood, there is some alteration of the protoplasm of the cells, probably due to the absence of salts and the cutting-off of the full oxygen supply by the presence of water, by which their resistance is considerably diminished in certain areas, and owing to which they are more readily attacked by the injected staphylococci.

Amount of Sugar in Blood in Disease.

Dr. N. P. Trinkler recently read, before the Kharkoff Medical Society, a paper on the "Diagnostic Significance of the Quantity of Sugar and Reducing Substances in the Blood," in which he detailed a number of observations he had carried out on patients in Professor Grube's surgical clinic, the majority of whom were suffering from cancer (*The Lancet*). The blood of some, as described in the *Medical Record* of Jan. 3, was taken for examination during an operation, that of the rest being only obtained after death. The examination was in all cases made by means of two processes, — that of Fehling and Soxhlet, and that of Knapp (Knapp's solution consists of cyanide of mercury dissolved in caustic alkali),— the mean of the two results being taken. He found that the blood during life always contains less sugar than after death, and that that of persons suffering from cancer contains a larger proportion of sugar and reducing substances than that of healthy persons, or of persons suffering from other diseases. Affections of internal organs appeared to be accompanied by a greater percentage of sugar in the blood than diseases of the skin or of external parts. The degree of emaciation produced by cancer did not seem to have any direct effect upon the quantity of sugar in the blood. There did not seem to be any real correspondence between the amounts of sugar and other reducing substances: the sugar was much more constant in its amount, the quantity of the other reducing substances being liable to very considerable variations. In the observations made on various diseased conditions, the following were the amounts of sugar found: cancer, 0.1678 per cent to 0.2037 per cent; typhoid-fever, 0.0950 per cent; pneumonia, 0.0943 per cent; dysentery, 0.0838 per cent; organic diseases of the heart, 0.0737 per cent; peritonitis, 0.701 per cent; phthisis, 0.0653 per cent; syphilis, 0.0553 per cent; nephritis, 0.0489 per cent; hæmaturia, 0.0375 per cent.

A Surgical Use for Ants.

Ants have very powerful jaws, considering the size of their bodies, and therefore their method of fighting is by biting. They will bite one another, and hold on with a wonderful grip of the jaws, even after their legs have been bitten off by other ants. Sometimes six or eight ants will be clinging with a death-grip to one another, making a peculiar spectacle, some with a leg gone, and some with half the body gone. One singular fact is, as we learn from the *Medical Record*, that the grip of an ant's jaw is retained even after the body has been bitten off and nothing but the head remains. This knowledge is possessed by a certain tribe of Indians in Brazil, who put the ants to a very peculiar use. When an Indian gets a gash cut in his hand, instead of having his hand sewed together, as physicians do in this country, he procures five or six large black ants, and, holding their heads near the gash, they bring their jaws together in biting the flesh, and thus pull the two sides of the gash together. Then the Indian pinches off the bodies of the ants, and leaves their heads clinging to the gash, which is held together until the gash is perfectly healed.

The Cradle of Influenza.

Professor Tessier, of the medical faculty of Lyons, has returned from Russia, whither he was sent last March to take evidence upon the course of influenza there, and the various conditions of its evolution. He found, according to the *Medical Record*, that influenza is a growth of Russian soil, and, when not a raging malady, is a smouldering one. The way the people live in winter, locked up in heated houses; the flatness of the soil, its consequent bad drainage, and universally sodden condition when the April thaw begins; the filthiness of the farm-yards, the village streets, and the rivers, which become suddenly swollen, and on falling leave a putrid mud behind,— all conduce to make influenza endemic. Its microbe is, in fact, to be found in this mud. Dr. Tessier calls it a strepto bacillus. What is peculiar in this dis-

ease is the alliance with this bacillus of pneumococcus, which also lives in Russian marshes, river-mud, and village pools.

Hunger and Infection.

It is a well-known fact, says the *Medical Press*, that hunger predisposes to certain diseases, but it has been reserved to two Turin doctors to demonstrate the increased liability experimentally. Their observations were carried out with the virus of bacillus anthrax on pigeons,—a disease to which these birds are, under ordinary circumstances, refractory. They found, however, that six days' total deprivation of food rendered the birds amenable to the virus, on condition that food was still withheld. If, however, food was given at the same time as the virus, then they still successfully resisted infection. Further, when starvation was continued for two days after the inoculation, and food then given, the development of the disease, though not prevented, ran a slower course. Lastly, the virus proved capable of infecting birds well fed up to the date of inoculation, but starved subsequently. The line of investigation is evidently one which admits of further research, but the moral is obvious.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Cyclones and Areas of High Pressure.

In his communication to *Science* of Jan. 16, Professor Ferrel speaks of my storming a camp in which he was not to be found. This I cannot consider entirely wasted effort, since it has enabled me to more exactly formulate the position which he does occupy. I, however, do not like the simile, for I am sure I can speak for Professor Davis when I say that we are not enemies trying to knock down, undermine, or even disparage Professor Ferrel's work; neither are we partisans whose duty, as Mr. McAdie appears to think, is to look with special favor upon views promulgated by our own countrymen, and with corresponding disfavor upon views of foreigners. We are merely scientific men, trying, with the best knowledge we can command, to determine the truth about a matter which certainly admits of a difference of opinion. I did not set out with the ambitious task of stating a new theory which was to stand out as a rival to the life-work of Espy and Ferrel, but merely to quote certain facts which to me indicate that the present theory of cyclones as commonly understood needs modification. As a result of my reading and continuous observation of weather-maps, I frequently frame new hypotheses to enable me to more closely follow and anticipate the phenomena that are presented to me. Some of these I stated in my last communication, rather hoping that the criticism of Professor Ferrel's well-stored mind would enable me to gain more light on them.

Had not Ferrel so warmly espoused the condensation theory, I should not have thought this an essential part of his own. Is it not Espy's theory, rather than Ferrel's, that needs reconsideration? Ferrel's work has been in showing the effect of the earth's rotation on atmospheric currents, and, it seems to me, is unassailable. He has shown more convincingly than any other writer the possibility of the existence of dynamic gradients as distinguished from thermic gradients; and we find Teisserenc DeBort calculating by Ferrel's formula how much of each cyclone is to be attributed to thermic and how much to dynamic gradients, and even going so far as to show that cyclones may exist in which there is only a dynamic gradient, the thermic gradient having disappeared. In his last article in *Science*, Professor Ferrel, in speaking of low temperature as a cause of high-pressure areas, says, "While I regard this as adequate to account for it, I have never said or thought that it is the only cause, but simply the principal cause. I think there are other causes, especially in the origin of these high-pressure areas."

In speaking of the case referred to by me of a long trough of low pressure becoming nearly circular by the increase of pressure at both ends, he says, "I do not say that in such a case there would not be a certain very small amount or gyratory movement produced by the air flowing into the trough while it was filling up, as it would be at once if there were no restraining force to keep the air from the high pressure on each side from rushing in."

But Professor Ferrel will say these are only secondary effects, and there must be an originating and sustaining force behind them. This he finds in differences of temperature in adjacent bodies of air, even admitting that cyclones of moderate power may exist without precipitation.

I do not think any one who has entered into this discussion, unless it be Professor Hazen, has doubted that differences of temperature resulting from solar energy is the ultimate power from which all cyclonic and anticyclonic phenomena are derived. I stated as clearly as I could, in my last article, that differences of temperature between pole and equator, ocean and continent, were, in my opinion, the ultimate cause of differences of pressure over large areas, and indirectly the cause of the smaller cyclones and anticyclones of our weather-maps. I have just read my statements over, and do not see how I could have made them any clearer, though Professor Ferrel apparently failed to understand them, and quotes for my benefit the fable of a tortoise standing on nothing and supporting the world.

Loomis believed that areas of high pressure, which he placed as the antecedent phenomena in the development of cyclones, were mainly the result of low temperature. Hann finds in the temperature gradient between equator and pole the force which originates and maintains cyclones.

As I understand it, then, the point at issue is as follows: Ferrel maintains that the essential condition for the development and continuance of a cyclone is a higher temperature within the field of the cyclone than in the surrounding air. Loomis and Hann, while not denying that cyclones may thus originate, conclude, as a result of the study of observational data, that cyclones also exist as secondary whirls resulting from atmospheric motions originating outside the area of the cyclone. The cyclones thus originated probably bear some analogy to the small whirls often seen in the current of a river.

I have little doubt that Ferrel's explanation of the general circulation of the winds is the correct one, and it is possible that the views of cyclone generation advanced by Loomis and Hann will need modification; but I believe that the observational data are sufficient to warrant the conclusion that the condensation theory needs modification.

Professor Ferrel appears to think that it is scarcely justifiable to advance a new hypothesis until it is certain that the older theory is inadequate. I cannot think, however, that this is the method by which science has been advanced. There was a time when the wave theory of light was less probable than the emission theory elaborated by the mathematical genius of Newton; and, if the less probable theory had not been thought over and discussed, the present position of optics could never have been reached. There was a time when the fluid theory of electricity was much more probable than any other; and, had not investigators sought other hypotheses which would explain the phenomena equally as well, or better, progress would have been greatly retarded.

Many other examples might be given, but these will suffice to show why I prefer the method of multiple hypothesis advocated by President Chamberlin to the method of not considering but one hypothesis or theory until it is absolutely certain that it is wrong.

If we only had some method of determining the air temperature at each successive height, it would be possible to calculate in any area of high pressure exactly how much of the high pressure was due to temperature, and how much was due to dynamic or other causes. There are certain limiting values, however, which observation and well-known physical laws render it safe to assume the mean temperature of any air-column will not depart greatly from: 1st, It is improbable that the decrease of temperature with height can ever be much or any greater than the adiabatic rate when the air above would be potentially heavier than the air below; 2d, It is improbable that the mean temperature of the air-column up

to 5,000 metres will be higher than the temperature observed at the earth's surface.

Taking the average decrease of temperature with height found from the observations on Pike's Peak and Mount Washington, and using the temperature and pressure recorded at stations on the daily weather-chart, I have, by Köppen's method, calculated the pressure at the height of 5,000 metres above a large number of areas of high pressure, and drawn isobars for this height. These show that above the larger number of winter anticyclones on our Western plains the pressure is lower than on the same latitude farther east. Even if we make the extreme assumption that there is no decrease of temperature above these anticyclones up to 5,000 metres, some of the cases will still show a lower pressure at this height than on the same latitude on each side. In these cases there seems no escape from the conclusion that the pressure at the earth's surface is due chiefly or entirely to the low temperature of the air. But there are other cases of anticyclones over these plains in the summer-time, and of anticyclones on our seacoast in winter, in which the temperature is as high as, or higher than, near the earth's surface within the anticyclones as on the same latitude farther west. In these cases it is sometimes difficult to get a lower pressure in the upper air above them, even though we assume the adiabatic rate of cooling. Moreover, I know that these high pressures on rare occasions extend up even to the cirrus region, for I have observed cirrus-clouds moving out from them toward the west in their south-west quadrant as the surface wind does near the earth. I am hence led to believe that there are two classes of anticyclones,— one due chiefly or entirely to low temperature, and the other due chiefly or entirely to dynamic causes. It seems to me probable that the same is true of cyclones.

H. HELM CLAYTON.

Blue Hill Observatory, Jan. 22.

Questions of Nomenclature.

PROFESSOR C. S. SARGENT, author of the "Silva of North America," says, in the first volume of that work, "I have adopted the method which imposes upon a plant the oldest generic name applied to it by Linnæus in the first edition of the 'Genera Plantarum,' published in 1737, or by any subsequent author, and the oldest specific name used by Linnæus in the first edition of 'Species Plantarum,' published in 1753, or by any subsequent author, without regard to the fact that such a specific name may have been associated at first with a generic name improperly employed."

To secure stability in nomenclature, it is obvious that the method adopted by Professor Sargent is the one which should universally be adopted by botanists. Other questions relating to botanical nomenclature are not so well settled as might be desired, and a few of these may be briefly stated, with the writer's present views concerning them.

The first in importance, perhaps, is the use of the names of forms at first described as varieties of other species, and later raised to specific rank, or *vice versa*. It would seem that the varietal name as first used should be adopted for the specific name when raised to specific rank, though many botanists have felt at liberty to rechristen them at pleasure. A varietal or subspecific name would, if this rule were followed, receive precedence over later names. Professor E. L. Greene, in "West American Oaks," has adopted the name *Quercus Palmeri* Engelm. in preference to *Q. Dunnii* Kell., although first published as a species under the latter name, *Q. Palmeri* having first been published as a subspecies by Dr. Engelmann, and later as a species. One is led to infer by Professor Greene's remarks, that, had *Q. Palmeri* been published as a variety instead of as a subspecies, he would have adopted Kellogg's name for the species, though why such a distinction is made is not very evident.

Bentham, in fact, held that the earliest published name, whether applied as a specific or varietal, belonged inalienably to that individual form, whether subsequently redescribed and raised to specific, or degraded to varietal rank.

"Once a synonyme always a synonyme," is a rule which I believe obtains among zoölogists in general, and should, if tenable with them, be adopted by botanists as well. This would necessitate some important changes if adopted; and as an instance may be noted the genus *Washingtonia*, now in use for our Californian fan-palms, a synonyme of *Sequoia*, having been unfortunately applied to our Californian giant before its application by Wendland to our palm.

If the facts permitted, some enterprising botanist might see fit to reinstate the coniferous genus, in which case the genus of palms would of necessity have to be renamed. Still, it seems like creating needless synonymy in this case to rechristen Wendland's genus, though strict adherence to the rule would render it imperative.

Uniformity in the method of citing the authors of species is another desideratum in botanical nomenclature. The most explicit custom is that adopted in general by zoölogists, — the enclosing in parentheses the name of the author of the species or variety, where originally given wrong rank, or referred to a genus incorrectly. While this is often cumbersome, yet it greatly facilitates subsequent work beyond question, and is preferable to the citing of the name of the author who has referred the plant in question to a different genus, or considered it as of different rank. The existing confusion in the manner of citations renders it impossible for a writer to do strict justice to the founders of species, unless he is favored with access to large botanical libraries, and blessed with abundant leisure for consulting original descriptions. The author of the species (or variety), it seems to the writer, is the one to be cited (if the system of double citation is discarded as inconvenient) in preference to the authority for its transferrence from one genus to another.

Another point upon which botanists are not fully agreed is the citation of names adopted in manuscripts or herbaria, and receiving earliest publication by others than their authors. It is the custom in America (and a sensible custom it is) to cite the real author's name, even when first described and published by another author (unless published by that author as of his own authorship). Thus, Nuttall is credited with the authorship of many genera and species first described by Torrey & Gray in the "Synoptical Flora," or by DeCandolle or others elsewhere.

It is now generally conceded that an author, after publishing a name, has no longer any right to substitute another name therefor in subsequent publications, even though the first name he finds to be a misnomer. This right, claimed by many of the older botanists of a past generation, is no longer contended for. It is also an open question as to how far published names may be changed or corrected by their own or subsequent authors.

A common Californian cactus is published by Prince Salm in "Cacteæ Horto Dyckensi," p. 91, as *Mamillaria Goodrichii* Scheer, named in honor of Mr. Goodrich. Professor Sereno Watson informs me that Seemann says in the "Botany of the 'Herald'" that it was a "Mr. J. Goodridge, surgeon," whom the plant was intended to commemorate in its name as its discoverer. The name, therefore, has been written *M. Goodridgii* by many subsequent authors. Gray (*Botanical Gazette*, ix. 53) inadvertently publishes *Antirrhinum Niveniаnum*, and repeats this spelling on the following page. This was collected by Rev. J. C. Nevin, and it is obviously proper to write *A. Nevinanum*, as the former spelling was mere inadvertence or a typographical error. But in the instance of *Mamillaria Goodrichii*, as originally written there is less cause for change, since the man may not have been clear in his own mind as to the correct spelling of his name,— like Shakspeare, spelling it differently at different times.

C. R. ORCUTT.

San Diego, Cal., Jan. 20.

BOOK-REVIEWS.

Inorganic Chemistry. By WILLIAM JAGO. London and New York, Longmans. 12°. $1.50.

THIS text-book is intended to meet certain conditions of science-teaching prevalent in Great Britain, due to the work going on under the auspices of the Science and Art Department. It is a more advanced book than the author's "Elementary Text-Book" on the same subject, issued some time ago. The supervision of

the English science-teaching by the Science and Art Department is to a considerable extent that of an examining board, so that the book before us appears to be written with the purpose of supplying a most condensed array of facts. As each substance is taken up, we are told of its occurrence, mode of preparation, properties, industrial applications, and composition. The author is evidently thoroughly practical by nature, and does not devote much space to the interesting theoretical discussions in chemistry, which would seem to give the study its chief disciplinary value, before he proceeds to the detailing of the facts. But let all teachers interested examine the book, that they may at least know the methods pursued by some of their co-workers abroad.

AMONG THE PUBLISHERS.

THE contents of the *Magazine of American History* for February cover a wide field of subjects. The features of the geologist and geographer, Sir Roderick Impey Murchison, appear in the frontispiece, accompanied by a sketch of his career in scientific discovery. The contribution of Hon. John Jay, LL.D., entitled "The Demand for Education in American History," is the longest and most important article of the number. Mr. Jay says, "Our great authorities on history-teaching are agreed that rightly to understand, appreciate, and defend American institutions, the true plan is to know their origin and their history." The third paper, by Rev. D. F. Lamson, presents an account of the emigration from New England to New Brunswick in 1763. The fourth paper is an illustrated account of the antiquity of carriages, by Emanuel Spencer. The article which follows is also illustrated, being the story of Sir Walter Raleigh's settlements on Roanoke Island, called by its author, Dr. Stephen B. Weeks, "An Historical Survival." Rev. R. T. Cross writes of early explorations in Louisiana; H. E. Green contributes a description of "The Pickering Manuscripts" in Boston; and "The French Army in the Revolution," translated from the French by Miss Georgine Holmes, is concluded from the January number.

— Mr. Greenough White has issued through the press of Ginn & Co. a pamphlet on "The Philosophy of American Literature," in which he endeavors to show that our literature is a native growth, and not a mere offshoot of that of England. In our opinion, the attempt is a failure. Mr. White gives a brief but excellent sketch of American literature, exhibiting its chief characteristics in the various periods, as he conceives them, very clearly; but he fails entirely to discover any real originality, or any thing distinctively American in thought or sentiment. Students of the subject will doubtless like to read Mr. White's work; but we think it will make few converts to the author's view. For our part, we can find little in our native literature but a reflex of European ideas; and we doubt if there is now extant a single work by an American writer that will be read except for historical purposes in the twentieth century.

— Readers of "Robert Elsmere" will be glad to hear that the address delivered by Mrs. Humphry Ward at the opening of University Hall has been reprinted in pamphlet form by Macmillan & Co. The special religious aims of University Hall are set forth in the pamphlet, in which mention is also made of the beginning of class-teaching under the guidance of Dr. Martineau. The same firm announce for early publication "The Life of the Right Hon. Arthur McMurrough Kavanagh," who was remarkable, having been born without arms or legs, notwithstanding which he sat in Parliament for many years, and yachted, hunted, and shot, carrying on the ordinary pursuits of a country gentleman and landlord.

— In an article entitled "An American Kew," in *Lippincott's Magazine* for February, 1891, Julian Hawthorne advocates the establishment in America of botanical gardens akin to the Kew Gardens in England. "When American naturalists," says Mr. Hawthorne, "have been furnished with a place where they can

study new plants and determine their qualities and uses under cultivation, investigate the animal and insect pests of the vegetable kingdom that have injured and still menace local plantations, devise means to aid in providing the growing population of the continent with good things to eat and plenty of them, prosecute inquiries into the medicinal virtues of herbs, and, in a word, canvass the whole possibilities for good of the world of plants, we may expect to see our country enter upon a scene of prosperity not unworthy of our hopes and promises." This is an idea that deserves to meet with encouragement, and it is to be hoped that its suggestion will lead to its fulfilment. Charles Howard Shinn, in an article entitled "West of the Sierras," gives an excellent idea of the rapid growth and development of the State of California, as well as of its climatic advantages, the beauty of its scenery, the productiveness of its soil, etc. Mr. Shinn's descriptions of the winter resorts of California will have a particular interest at this season.

— The "Handbook of Florida," by Charles Ledyard Norton, just issued by Longmans, Green, & Co., New York, will certainly prove useful to tourists and intending settlers. The book is illustrated by forty-nine maps and plans, especial attention being given to county maps showing lines of railway. It is claimed that these last have never before been published together in such convenient shape.

— The Farmers' Alliance of Delaware has invited Professor Edmund J. James, president of the American Academy of Political and Social Science, to address the State convention at Wilmington on the subject of "Our System of Taxation in its Relation to the Farming Classes." The farmers wish to know especially whether any State has solved the problem of relieving the farming classes of the burdens which rest upon them. It will be interesting to learn what a theoretical student of taxation has to say upon this subject, and whether he will give the farmers much satisfaction. Would it not be a desirable thing for the government to call for a report upon our financial system from some of the expert students of taxation in the country, and try to find out whether the scholars have any thing valuable to say on this subject which is vexing everybody just now?

— The Shakespeare Society of New York, 21 Park Row, New York City, announces a four-text edition of "Hamlet," presenting a parallelization of the three versions of that play, which appeared in 1603, 1604, and 1623, exactly reproducing the archaic typography and characteristics of the same, *verb. lit. et punct.*, accompanied by a translation of the German version performed in Dresden in 1626, and supposed to have been brought into Germany from London by English actors in 1603, and which throws a curious historical light upon the actual stage reading of the tragedy as presented by the London actors. The project of a four-text "Hamlet" was a favorite with the New Shakespeare Society of London, which, as long ago as 1874, promised one, but succumbed to the typographical difficulties of the work, and finally abandoned the project. The New York Shakespeare Society believes it has surmounted those difficulties, and undertakes to furnish its subscribers, in or about the fall of 1891, with the four texts,— a volume in folio, about 16 x 10, printed on laid paper, de luxe, in the best style of The Riverside Press, about 200 pages, and bound in boards, parchment back, Bankside or Roxburge style. One hundred and fifty copies only are to be printed from the types, and hand-numbered under the society's direction.

— In *Outing* for February, 1891, we note "Cycling in Mid-Atlantic," by Osbert H. Howarth; "Rowing at Oxford," by Charles H. Mellen; "The Art of Daguerre," by Clarence B. Moore; "Tarpon-Fishing in Florida," by J. M. Murphy; "The Poodle," by E. H. Morris; "Ice-Fishing in the Sea of Azoff," by C. A. P. Talbot; "Wolf-Hunting in France," by Sidney H. Smith; and "Turkey-Tracking in Canadian Snow-Fields," by E. Sandys.

SCIENCE

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CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Jan. 31. — C. V. Riley, Bacteriology in Applied Entomology; H. W. Turner, On an Extinct Lake of Pleistocene Times in the Sierra Nevada, California; W. J. McGee, The Flood Plains of Rivers.

Women's Anthropological Society of America, Washington.

Jan. 31. — Miss L. M. Dame, The Heroic Age.

Natural Science Association of Staten Island.

Jan. 10. — Arthur Hollick, Additions to the Flora of the Island.

Boston Society of Natural History.

Feb. 4. — G. H. Barton, The Hawaiian Islands, their Natural History and Inhabitants (illustrated with a stereopticon); J. H. Emerton, Exhibition of a New Model of Oahu lately made by him for the Museum of the Society.

Royal Meteorological Society, London.

Dec. 21, 1890, Annual Meeting.—Dr. Tripe read the report of the council. Among the investigations carried on by the society are the following: the organization of a large number of meteorological stations, the observations from which are examined and reduced by the staff, and printed in the *Meteorological Record;* the regular inspection of these stations by the assistant secretary; the collection and discussion of phenological observations; and an inquiry into the thunder-storms of 1888 and 1889. An exhibition of instruments is held annually in March. During the year a complete catalogue of the library, extending to 222 pages, has been compiled and published.

Ordinary Meeting.—R. H. Scott, Note on a Peculiar Development of Cirrus Cloud observed in Southern Switzerland; W. F. Badgley, Some Remarks on Dew. These are notes on observations which were made to discover whether all dew is deposited from the air, or if some also comes from the earth and plants, and also what quantity is formed during the year. The conclusions which the author deduces from his observations are (1) that the earth always exhales water-vapor by night, and probably a greater quantity by day; (2) that the quantity of water-vapor given off by the earth is always considerable, and that any variation in the quantity is mainly due to the season of the year; (3) that the greater part of the dew comes from the earth-vapor; and (4) that plants exhale water-vapor, and do not exude moisture. The total quantity of dew collected on the author's grass-plates in the year was 1.6147 inches.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—A young man who has been teaching in a first-class High School desires a position in a similar institution. Is competent to teach Mathematics, Latin, Book-keeping, and the English branches. Can give highest references Address H. W. MARTHENS, 6208 Broad St., Pittsburgh, Pa.

WANTED.—An Institution that has not, and would desire, a complete set of the proceedings of the American Association for the Advancement of Science, and would keep them entire in its library. Apply to Editor of *Science*.

WANTED.—By a medical student of three courses, a position on some war or mercantile vessel sailing between America and some foreign country, as Clerk, Assistant Physician or Druggist, or any respectable occupation. Content with a moderate remuneration. Highest commendations. W. L. S., *Science* Office.

INFORMATION WANTED.—Clarence W. Bowen, Secretary of the Committee on the Centennial of Washington's Inauguration, 251 Broadway, New York, desires information regarding the portraits of John Hathorn and Jeremiah Van Rensselaer, members of Congress from New York. These portraits, for the Memorial Volume, are particularly desired, to complete the list of portraits of the New York delegation in Congress at the time of Washington's inauguration.

WANTED. — One first-class instrument-maker. Apply by letter to T. C. MENDENHALL, Superintendent U. S. Coast and Geodetic Survey, Washington, D. C

WANTED.—A Botanist and Entomologist to accompany a camping party of boys during July next. Address, stating experience and salary expected. ALBERT L. AREY, Free Academy, Rochester, N. Y.

WANTED.—A young man wishes a position in an experiment station, botanical department preferred. References and evidence of competency on application. Address E E. BOGUE. Agr. Experiment Station, Columbus, O.

WANTED—Employment or partial employment as naturalist collector for all Ornithological, Entomological or Zoological specimens. First class Canadian references supplied. Would be willing to work in Canada or any part of America as desired. Salary or commission. G. E. ATKINSON, 639 Spadina Ave., Toronto, Can.

WANTED.—A situation in a scientific house by a graduate of the scientific department of the Jersey City High School as Geologist, Mineralogist or as assistant teacher in Physics or assistant to a chemist. Best of references. E. W. PERRY, 582 Third Street, Jersey City, N. J.

A UNIVERSITY GRADUATE IN SCIENCE, at present a junior student in medicine at the University of Michigan, desires a position as teacher or laboratory assistant. Special preparation in Zoology, Histology, Physiology and Human Anatomy. Will also teach, if desired, Physics, Chemistry, Botany, Entomology, Embryology, Bacteriology and Sanitary Science. References and full particulars on application. H. B., 20 East Jefferson St., Ann Arbor, Mich.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

I have a good supply of Eastern Coleoptera which I wish to exchange for species not in my collection. Melandryidae and Oedemeridae especially desired. Joe C. Thompson, Rosebank P. O., Box 73, S. I.

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1890 Seeger and Guernsey Cyclopedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost $6. David R. Lewis, Saybrook, Ill.

SCIENCE

NEW YORK, FEBRUARY 6, 1891.

THE STUDY OF INDIAN LANGUAGES.

As the number of those interested in the study of Indian languages increases, the need of a complete classification of Indian languages and dialects becomes more and more apparent. The investigations necessary to such a classification were begun many years ago by the Bureau of Ethnology, and from time to time field investigations have been conducted with especial reference to it Sufficient progress has been made to permit the publication of a classification of all Indian languages in the territory north of Mexico, together with a map displaying the area occupied by the several families.

The classification is primarily based upon an examination of the linguistic material relating to the subject. Mr. James C. Pilling has been engaged in the preparation of the bibliography of this literature, and several volumes of the bibliography have already been published. The literature itself is classified by him as far as possible in compliance with this scheme. Secondarily the classification is based on a large body of linguistic material now in the archives of the bureau, which also received notice in Mr. Pilling's "Bibliography."

Mr. H. W. Henshaw is engaged on the tribal synonymy, and a large volume on this subject is approaching completion. The tribal synonymy is also based upon this classification. The classification itself is the work of the Director of the bureau.

It will of course be understood that such a classification must be purely tentative, and that it will require modification as new material is acquired by students, and as present views in regard to the relationship of existing families may be changed by further study. All the material relating to the classification will appear in the seventh annual report of the bureau, now in the hands of the printer.

The subject is deemed of sufficient interest and importance to warrant the present publication of the principles upon which the classification has been based. and of the rules which have guided in the selection of family names, together with a list of the families.

The languages spoken by the pre-Columbian tribes of North America were many and diverse. Into the regions occupied by these tribes, travellers, traders, and missionaries have penetrated in advance of civilization, and civilization itself has marched across the continent at a rapid rate. Under these conditions, the languages of the various tribes have received much study. Many extensive works have been published, embracing grammars and dictionaries ; but a far greater number of minor vocabularies have been collected, and very many have been published. In addition to these, the Bible, in whole or in part, and various religious books and school-books, have been translated into Indian tongues, to be used for purposes of instruction, and newspapers have been published in the Indian languages. Altogether the literature in these languages, together with the literature relating to it, is of vast extent. While the materials seem thus to be abundant, the student of Indian languages finds the subject to be one of great magnitude, difficulties arising from the following conditions: —

1. A great number of linguistic stocks or families is discovered.

2. The boundaries between the different stocks of languages are not immediately apparent, from the fact that many tribes of diverse stocks have had more or less association, and to some extent linguistic materials have been borrowed, and thus have passed out of the exclusive possession of cognate peoples.

3. Where many peoples, each few in number, are thrown together, an intertribal language is developed. To a large extent this is gesture speech; but to a limited extent useful and important words are adopted by various tribes, and out of this material an intertribal "jargon" is established. Travellers and all others, who do not thoroughly study a language, are far more likely to acquire this jargon speech than the real speech of the people ; and the tendency to base relationship upon such jargons has led to confusion.

4. This tendency to the establishment of an intertribal jargon was greatly accelerated on the advent of the white man, for thereby many tribes were pushed from their ancestral homes, and tribes were mixed with tribes. As a result, new relations and new industries, especially of trade, were established, and the new associations of tribe with tribe and of the Indians with Europeans led very often to the development of quite elaborate jargon languages. All of these have a tendency to complicate the study of the Indian tongues by comparative methods.

The difficulties inherent in the study of languages, together with the imperfect material and the complicating conditions that have arisen by the spread of civilization over the country, combine to make the problem one not readily resolved.

In view of the amount of material on hand, the comparative study of the languages of North America has been strangely neglected, though perhaps this is explained by reason of the difficulties which have been pointed out. And the attempts which have been made to classify them has given rise to much confusion, for the following reasons: first, later authors have not properly recognized the work of earlier laborers in the field; second, the attempt has more frequently been made to establish an ethnic classification than a linguistic classification, and linguistic characteristics have been confused with biotic peculiarities, arts, habits, customs, and other human activities, so that often radical differences of language have been ignored, and slight differences have been held to be of primary value.

The attempts at a classification of these languages and also at a classification of races have led to the development of a complex, mixed, and inconsistent synonymy, which must first be unravelled and a selection of standard names made therefrom, according to fixed principles.

It is manifest that until proper rules are recognized by scholars the establishment of a determinate nomenclature is impossible. It will therefore be well to set forth the rules that have here been adopted, together with brief reasons for

the same, with the hope that they will commend themselves to the judgment of other persons engaged in researches relating to the languages of North America.

A fixed nomenclature in biology has been found not only to be advantageous, but to be a prerequisite to progress in research, as the vast multiplicity of facts, still ever accumulating, would otherwise overwhelm the scholar. In philological classification, fixity of nomenclature is of corresponding importance; and while the analogies between linguistic and biotic classification are quite limited, many of the principles of nomenclature which biologists have adopted having no application in philology, still, in some important particulars the requirements of all scientific classifications are alike, and, though many of the nomenclatural points met with in biology will not occur in philology, some of them do occur, and may be governed by the same rules.

Perhaps an ideal nomenclature in biology may sometimes be established, as attempts have been made to establish such a system in chemistry; and perhaps such an ideal system may eventually be established in philology. Be that as it may, the time has not yet come even for its suggestion. What is now needed are rules of some kind leading scholars to use the same terms for the same things; and it would seem to matter little in the case of linguistic stocks what the nomenclature is, provided it becomes denotive and universal.

In treating of the languages of North America, it has been suggested that the names adopted should be the names by which the people recognize themselves; but this is a rule of impossible application, for, where the branches of a stock diverge very greatly, no common name for the people can be found. Again, it has been suggested that names which are to go permanently into science should be simple and euphonic. This also is of impossible application, for simplicity and euphony are largely questions of personal taste; and he who has studied many languages loses speedily his idiosyncrasies of likes and dislikes, and learns that words foreign to his vocabulary are not necessarily barbaric.

Biologists have decided that he who first distinctly characterizes and names a species or other group shall thereby cause the name thus used to become permanently affixed, but under certain conditions adapted to a growing science which is continually revising its classification. This law of priority may well be adopted by philologists.

By the application of the law of priority it will occasionally happen that a name must be taken which is not wholly unobjectionable, or which could be much improved; but, if names may be modified for any reason, the extent of change that may be wrought in this manner is unlimited, and such modifications would ultimately become equivalent to the introduction of new names, and a fixed nomenclature would thereby be overthrown. The rule of priority has therefore been adopted.

Permanent biologic nomenclature dates from the time of Linnæus, simply because this great naturalist established the binominal system and placed scientific classification upon a sound and enduring basis. As Linnæus is to be regarded as the founder of biologic classification, so Gallatin may be considered the founder of systematic philology relating to the North American Indians. Before his time much linguistic work had been accomplished; and scholars owe a lasting debt of gratitude to Barton, Adelung, Pickering, and others. But Gallatin's work marks an era in American linguistic science from the fact that he so thoroughly introduced comparative methods, and because he circumscribed the boundaries of many families, so that a large part of his work remains and is still to be considered sound. There is no safe resting-place anterior to Gallatin, because no scholar prior to his time had properly adopted comparative methods of research, and because no scholar was privileged to work with so large a body of material. It must further be said of Gallatin that he had a very clear conception of the task he was performing, and brought to it both learning and wisdom. Gallatin's work has therefore been taken as the starting-point, back of which we may not go in the historic consideration of the systematic philology of North America. The point of departure, therefore, is the year 1836, when Gallatin's "Synopsis of Indian Tribes" appeared in Vol. II. of the "Transactions of the American Antiquarian Society."

It is believed that a name should be simply a denotive word, and that no advantage can accrue from a descriptive or connotive title. It is therefore desirable to have the names as simple as possible, consistent with other and more important considerations. For this reason it has been found impracticable to recognize as family names designations based on several distinct terms, such as descriptive phrases, and words compounded from two or more geographic names. Such phrases and compound words have been rejected.

There are many linguistic families in North America, and in a number of them there are many tribes speaking diverse languages. It is important, therefore, that some form should be given to the family name by which it may be distinguished from the name of a single tribe or language. In many cases some one language within a stock has been taken as the type, and its name given to the entire family; so that the name of a language and that of the stock to which it belongs are the same. This is inconvenient, and leads to confusion. For such reasons it has been decided to give each family name the termination "an" or "ian."

Conforming to the principles thus enunciated, the following rules have been formulated: —

1. The law of priority relating to the nomenclature of the systematic philology of the North American tribes shall not extend to authors whose works are of date anterior to the year 1836.

2. The name originally given by the founder of a linguistic group to designate it as a family or stock of languages shall be permanently retained to the exclusion of all others.

3. No family name shall be recognized if composed of more than one word.

4. A family name, once established, shall not be cancelled in any subsequent division of the group, but shall be retained in a restricted sense for one of its constituent portions.

5. Family names shall be distinguished as such by the termination "an" or "ian."

6. No name shall be accepted for a linguistic family unless used to designate a tribe or group of tribes as a linguistic stock.

7. No family name shall be accepted unless there is given the habitat of the tribe or tribes to which it is applied.

8. The original orthography of a name shall be rigidly preserved, except as provided for in Rule 3, and unless a typographical error is evident.

The terms "family" and "stock" are here applied interchangeably to a group of languages that are supposed to be cognate.

A single language is called a stock or family when it is not found to be cognate with any other language. Languages are said to be cognate when such relations between

them are found that they are supposed to have descended from a common ancestral speech.

The evidence of cognation is derived exclusively from the vocabulary. Grammatic similarities are not supposed to furnish evidence of cognation, but to be phenomena, in part relating to stage of culture, and in part adventitious. It must be remembered that extreme peculiarities of grammar, like the vocalic mutations of the Hebrew or the monosyllabic separation of the Chinese, have not been discovered among Indian tongues. It therefore becomes necessary, in the classification of Indian languages into families, to neglect grammatic structure, and to consider lexical elements only. But this statement must be clearly understood. It is postulated that in the growth of languages new words are formed by combination, and that these new words change by attrition to secure economy of utterance, and also by assimilation (analogy) for economy of thought. In the comparison of languages for the purposes of systematic philology it often becomes necessary to dismember compounded words for the purpose of comparing the more primitive forms thus obtained. The paradigmatic words considered in grammatic treatises may often be the very words which should be dissected to discover in their elements primary affinities; but the comparison is still lexic, not grammatic.

A lexic comparison is between vocal elements: a grammatic comparison is between grammatic methods, such, for example, as gender systems. The classes into which things are relegated by distinction of gender may be animate and inanimate, and the animate may subsequently be divided into male and female, and these two classes may ultimately absorb, in part at least, inanimate things. The growth of a system of genders may take another course. The animate and inanimate may be subdivided into the standing, the sitting, and the lying, or into the moving, the erect, and the reclined; or, still further, the superposed classification may be based upon the supposed constitution of things, as the fleshy, the woody, the rocky, the earthy, the watery. Thus the number of genders may increase, while farther on in the history of a language the genders may decrease so as almost to disappear. All of these characteristics are in part adventitious; but to a large extent the gender is a phenomenon of growth, indicating the stage to which the language has attained. A proper case system may not have been established in a language by the fixing of case particles, or, having been established, it may change by the increase or diminution of the number of cases. A tense system also has a beginning, a growth, and a decadence. A mode system is variable in the various stages of the history of a language. In like manner a pronominal system undergoes changes. Particles may be prefixed, infixed, or affixed in compounded words, and which one of these methods will finally prevail can be determined only in the later stage of growth. All of these things are held to belong to the grammar of a language, and to be grammatic methods distinct from lexic elements.

With terms thus defined, languages are supposed to be cognate when fundamental similarities are discovered in their lexic elements. When the members of a family of languages are to be classed in subdivisions and the history of such languages investigated, grammatic characteristics become of primary importance. The words of a language change by the methods described, but the fundamental elements or roots are more enduring. Grammatic methods also change, perhaps even more rapidly than words; and the changes may go on to such an extent that primitive methods are entirely lost, there being no radical grammatic elements to be preserved. Grammatic structure is but a phase or accident of growth, and not a primordial element of language. The roots of a language are its most permanent characteristics; and while the words which are formed from them may change so as to obscure their elements, or in some cases even to lose them, it seems that they are never lost from all, but can be recovered in large part. The grammatic structure or plan of a language is forever changing, and in this respect the language may become entirely transformed.

Below is a list of the fifty-eight families, alphabetically arranged, with a general statement of the habitat of each. Most of the names contained in the list need no explanation, as they are familiar to linguistic students, having appeared years ago in the writings of Gallatin, Latham, Prichard, Scouler, Turner, and others. Several of the names are new. Thus, the name "Chumashan" is applied to the group of languages hitherto generally known under the term "Santa Barbara," and includes the dialects formerly spoken at the several missions along the Santa Barbara Channel, California, and is derived from the name of the Santa Rosa Island tribe. This language is now spoken by a score or more of Indians.

The Esselenian family applies to the language of a tribe, possibly a small group of tribes, on and south of Monterey Bay. Until recently the language has been supposed to belong to the Moquelumnan family, but is now believed to represent a distinct group. The family name is derived from the name of the Esselen tribe. The language is now practically extinct, but a short vocabulary was collected by Mr. Henshaw in 1888.

The Yanan family includes one language only, that of the tribe called by Powers, Gatschet, and others, "Nozi" or "Noces." The word means "people" in their own language.

List of Families.

Adaizan.— On Red River, Texas.

Algonquian.— Of the North Atlantic seaboard, and west through the Northern States, Lake region, and Canada, to the Rocky Mountains.

Athapascan.— Of the interior of British America; isolated communities on the Columbia River, Oregon, California, Arizona, and New Mexico.

Attacapan.— Area on Texas coast.

Beothukan.— Portion of Newfoundland.

Caddoan.— Of northern Nebraska, western Arkansas, southern Indian Territory, western Louisiana, and northern Texas.

Chimakuan.— Of part of the southern shore of Puget Sound.

Chimarikan.— On New and Trinity Rivers, northern California.

Chimmesyan.— The region of Nasse and Skeena Rivers, west coast British Columbia.

Chinookan.— Banks of the Columbia River as far up as the Dalles.

Chitimachan.— About Lake Barataria, southern Louisiana.

Chumashan.— Coast of California from about the 34th parallel to a little north of the 35th.

Coahuiltecan.— Of south-western Texas and north-eastern Mexico.

Copehan.— West of the Sacramento as far north as Mount Shasta, California.

Costanoan.— Coast of California from the Golden Gate south to Monterey Bay.

Eskimauan.— East and west coasts of Greenland; coast of Labrador as far south as Hamilton Inlet; and the Arc-

tic coast westward, including part of the shore of Hudson Bay, to western Alaska, including the Aleutian Islands.

Esselenian.— Coast of California from Monterey Bay to Santa Lucia Mountain.

Iroquoian.— The St. Lawrence River region north of Lake Erie, northern Pennsylvania, State of New York, the lower Susquehanna in Pennsylvania and Maryland, north-eastern North Carolina, south-western West Virginia, western North Carolina, and most of Kentucky and Tennessee.

Kalapooian.— Valley of the Willamette River, Oregon.

Karankawan.— Texas coast around Matagorda Bay.

Keresan.— Upper Rio Grande, and on the Jemez and San José Rivers, New Mexico.

Kiowan.— Upper Arkansas and Purgatory Rivers, Colorado.

Kitunahan.— Cootenay River region, mostly in British Columbia.

Koluschan.— North-west coast from 55° to 60° north latitude.

Kulanapan.— Russian River region, and California coast from Bodega Head north to about latitude 39° 30′.

Kusan.— Coast of middle Oregon, Coos Bay and River, and at mouth of Coquille River, Oregon.

Lutuamian.— Region of Klamath Lakes and Sprague River, Oregon.

Mariposan.— Interior of California, east of the Coast Range, and south of Tulare Lake, in a narrow strip to below Tulare Lake, north as far as the Fresno River.

Moquelumnan.— Interior of California, bounded on the north by the Cosumnes River, on the south by the Fresno, on the east by the Sierras, and on the west by the San Joaquin; an area north of San Francisco and San Pablo Bays as far as Bodega Head and the head waters of Russian River.

Muskhogean.— The Gulf States from the Savannah River and the Atlantic west to the Mississippi, and from the Gulf to the Tennessee River.

Natchesan.— On St. Catherine Creek, near the site of the present city of Natches.

Palaihnihan.— Drainage of Pit River in north-eastern California.

Piman.— On the Gila River about 160 miles from its mouth, and on the San Pedro, in Arizona, and in Mexico on the Gulf of California.

Pujunan.— California; east bank of the Sacramento about 100 miles from its mouth, north to Pit River, eastward nearly to the borders of the State.

Quoratean.— Lower Klamath River, Oregon, from Happy Camp to the junction of the Trinity and Salmon River valley.

Salinan.— Region around the San Antonio and San Miguel missions, California.

Salishan.— North-western part of Washington, including Puget Sound, eastern Vancouver Island to about midway its length; coast of British Columbia to Bute Inlet; and the region of Bentinck Arm and Dean Inlet.

Sastean.— Middle Klamath River, northern California.

Shahaptian.— Upper Columbia River, and its tributaries in northern Oregon and Idaho and southern Washington.

Shoshonean.— Occupying generally the Great Interior Basin of the United States, as far east as the Plains, and reaching the Pacific in Los Angeles, San Bernardino, and San Diego Counties, California.

Siouan.— The Dakotas, parts of Minnesota, Wisconsin, Iowa, Nebraska, Kansas, Missouri, Arkansas, Indian Territory, with isolated colonies in Alabama (Biloxi), the Carolinas (Catawba), and borders of Virginia and North Carolina (Tutelo).

Skittagetan.— Queen Charlotte Islands, Forrester Island, and south-eastern part of Prince of Wales Island.

Takilman.— Oregon coast about the lower Rogue River.

Tañoan.— Rio Grande and tributary valleys, from about 30° to about 36° 30′.

Timuquanan.— Florida.

Tonikan.— Lower Yazoo River, Mississippi.

Tonkawan.— Western and south-western parts of Texas.

Uchean.— Lower Savannah River and perhaps the South Carolina coast.

Waiilatpuan.— Lower Walla Walla River, Oregon, and about Mounts Hood and Jefferson.

Wakashan.— West coast of Vancouver Island, and north-west tip of Washington.

Washoan.— Eastern base of the Sierras, south of Reno, Nevada, to the lower end of Carson valley.

Weitspekan.— Lower Klamath River, Oregon, from the mouth of the Trinity.

Wishoskan.— Coast of California from just below the mouth of Eel River to a little north of Mad River.

Yakonan.— Along the lower Yaquina, Alsea, Siuslaw, and Umpqua Rivers, Oregon.

Yanan.— Chiefly in the southern part of Shasta County, California.

Yukian.— Round valley, California, and west to the coast.

Yuman.— Lower California; the Colorado from its mouth to Cataract Creek, the Gila and tributaries as far east as the Tonto Basin, Arizona.

Zuñian.—A small area on Zuñi River, western New Mexico.

J. W. Powell.

NOTES AND NEWS.

The director of the central dispensary at Bagdad has sent to *La Nature* a specimen of an edible substance which fell during an abundant shower in the neighborhood of Merdin and Diarbékir (Turkey in Asia) in August, 1890. The rain which accompanied the substance fell over a surface of about ten kilometres in circumference. The inhabitants collected the "manna," and made it into bread, which is said to have been very good, and to have been easily digested. The specimen sent to *La Nature* is composed of small spherules, according to *Nature* of Jan. 15. Yellowish on the outside, it is white within. Botanists who have examined it say that it belongs to the family of lichens known as *Lecanora esculenta*. According to Decaisne, this lichen, which has been found in Algeria, is most frequently met with on the most arid mountains of Tartary, where it lies among pebbles from which it can be distinguished only by experienced observers. It is also found in the desert of the Kirghizes. The traveller Parrot brought to Europe specimens of a quantity which had fallen in several districts of Persia at the beginning of 1828. He was assured that the ground was covered with the substance to the height of two decimetres, that animals ate it eagerly, and that it was collected by the people.

— Mr. William Warren supplies some information to *Engineering* regarding his work in the search for seams of coal in Tonquin, which, as the result of the late wars there, is now part of the French territory. The coal, of which there is an extensive field, will add greatly to the importance of the territorial acquisition to the French in view of its importance as a coaling station, and will afford a further evidence of the varying fortunes of politicians, as M. Ferry, rising from the obloquy into which he fell as a result of the public disapproval of the continuance of the campaign, will now find favor and commendation for foresight. The seams of

coal have been known for something like half a century. They crop out all round the bases of lowish hills which fringe the shores of the Gulf of Tonquin. One of the seams is 152 feet thick, of almost solid coal. It is a semi-anthracite of very fine quality, having about 87 per cent of fixed carbon, and from 7 to 12½ per cent of volatile matter, from 2 to 3 per cent ash, free from pyrites, and of course quite smokeless. A steamer named "Fatshan," of fourteen knots speed, has been tried with 300 tons of the coal. The results were very satisfactory, the vessel steaming well at a fully maintained speed, with almost the same consumption as in the case of Cardiff coal. The discovery is a serious one for the Japanese coal industry, as Hong-Kong formerly took about 50,000 tons monthly. The Japan coal has 23 to 27 per cent of ash, against 2 to 3 per cent in the Tonquin coal. The gain in decreased consumption is enhanced by reason of the increased cargo space available, or, in other cases, in allowing the vessels to keep the sea for a longer time.

— The lion is eaten by some African races, but its flesh is held in small esteem. The Zulus find carrion so much to their liking, that, according to the late Bishop Colenso, they apply to food peopled by large colonies of larvæ the expressive word "uborni," signifying in their uncouth jargon "great happiness." David Livingstone, that keen and accurate observer, reminds us that the aboriginal Australians and Hottentots prefer the intestines of animals. "It is curious," he says, "that this is the part which animals always begin with, and it is the first choice of our men." On this point it may be well to remind the civilized reader that the woodcock and the red mullet, or sea woodcock, are both eaten and relished without undergoing all the cleaning processes which most animals used for food among us generally experience to fit them for the table; so that our aversion to the entrails of animals is not absolute, but only one of degree. The hippopotamus is a favorite dish with some Africans when they can get this unwieldy and formidable river monster, and when young its flesh is good and palatable, but with advancing years it becomes coarse and unpleasant. The Abyssinians, the amiable people to whom, according to the Italian prime minister, his countrymen proposed to teach wisdom and humanity, find the rhinoceros to their taste: so they do the elephant, which is also eaten in Sumatra. Dr. Livingstone describes the elephant's foot as delicious, and his praises will be echoed by many travellers in lands where that sagacious monster still lingers in rapidly decreasing numbers. "We had the foot," wrote the doctor, "cooked for breakfast next morning, and found it delicious. It is a whitish mass, slightly gelatinous, and sweet like marrow. A long march to prevent biliousness is a wise precaution after a meal of elephant's foot. Elephant's tongue and trunk are also good, and, after long simmering, much resemble the hump of a buffalo and the tongue of an ox; but all the other meat is tough, and, from its peculiar flavor, only to be eaten by a hungry man."

— The London *Times* for Jan. 19 contains some interesting information about the manuscript of Aristotle recently discovered in Egypt, and now in the British Museum. It is described as a constitutional history of Athens, and as one of a collection of constitutions which Aristotle accumulated, describing various ancient states, and numbering 158. The treatise in its present form contains 63 chapters of the size of those in Thucydides; but the first chapter is missing, and a few at the end mutilated. It is written on three papyrus rolls, and on what is called the *verso*, or back, side; the *recto* being occupied with the record of the bailiff's receipts and expenditures on a private estate in Egypt, dated month by month in the eleventh year of Vespasian, about A.D. 79. This record, which shows some of the peculiarities of writing found in the treatise itself, tends strongly to confirm the genuineness of the manuscript, which is further proved by the fact, that, of 91 passages in ancient writers known or believed to be quoted from this work, 78 are in this manuscript, and the others may reasonably be referred to those parts that are lost. Of the 63 chapters, 41 relate the constitutional changes in the Athenian state from the time of Cylon in 632 B.C., to the restoration of the democracy in B.C. 403, while the remaining chapters describe the duties of the various magistrates. It is said that the work will not alter our general views of Greek history, but supplies many new details, and fixes many dates that were heretofore uncertain. One of the most important items thus revealed to us is the fact that Themistocles took a leading part in the overthrow of the Areopagus, he being a member of that body at the time. The text of the work has been printed, and will shortly be published, with introduction and notes by F. G. Kenyon, an assistant at the museum in the department of manuscripts; and it will also be issued in facsimile. The finding of this work, together with some discoveries of less importance previously made in Egypt, give ground for hope that other classical works, including some of the lost lyric and dramatic poetry, may yet be recovered.

— Capt. de Place of Paris has invented an instrument for detecting flaws in metal castings and forgings, which is called the "sciséophone." According to the London *Times*, the apparatus consists of a small pneumatic tapper worked by the hand, and with which the piece of steel or iron to be tested is tapped all over. Connected with the tapper is a telephone with a microphone interposed in the circuit. Two operators are required, — one to apply the tapper, and the other to listen through the telephone to the sounds produced. These operators are in separate apartments, so that the direct sounds of the taps may not disturb the listener, whose province it is to detect flaws. The two, however, are in electrical communication, so that the instant the listener hears a false sound he can signal to his colleague to mark the metal at the point of the last tap. In practice the listener sits with the telephone to his ear, and so long as the taps are normal he does nothing. Directly a false sound (which is very distinct from the normal sound) is heard, he at once signals for the spot to be marked. By this means he is able not only to detect a flaw, but to localize it. Under the auspices of the South eastern Railway Company, a demonstration of the sciséophone was given by Capt. de Place, at the Charing Cross Hotel, in the presence of several members of the Ordnance Committee and other government officials. Mr. Stirling, the company's locomotive superintendent, had previously had several samples of steel, wrought iron, and cast iron prepared with hidden flaws known only to himself. The first sample tested by Capt. de Place he pronounced to be bad metal throughout, which Mr. Stirling stated he knew it to be. Other samples were tested, and the flaws localized by means of the apparatus. On some of the bars of wrought and cast iron being broken, the internal flaws, the localities of which were known to Mr. Stirling by his private mark, were found to have been correctly localized by Capt. de Place. On the other hand, some bars were broken at points where the apparatus indicated a flaw, but where the metal proved to be perfectly sound; so that the apparatus is not yet quite trustworthy.

— Dr. William Crookes delivered his presidential address before the Institution of Electrical Engineers, London, on Thursday, Jan. 15, taking as his subject "Electricity *in transitu:* from *Plenum* to *Vacuum*." In his introductory remarks, as we learn from *Nature*, he explained that he was about to treat electricity, not so much as an end in itself, but rather as a tool, by whose judicious use we may gain some addition to our scanty knowledge of the atoms and molecules of matter, and of the forms of energy which by their mutual re-actions constitute the universe as it is manifest to our five senses. Explaining what he meant in characterizing electricity as a tool, he said, that, when working as a chemist in the laboratory, he found the induction spark often of great service in discriminating one element from another, also in indicating the presence of hitherto unknown elements in other bodies in quantity far too minute to be recognizable by any other means. In this way chemists have discovered thallium, gallium, germanium, and numerous other elements. On the other hand, in the examination of electrical re-actions in high *vacua*, various rare chemical elements become in turn tests for recognizing the intensity and character of electric energy. Electricity, positive and negative, effect respectively different movements and luminosities: hence the behavior of the substances upon which electricity acts may indicate with which of these two kinds we have to deal. In other physical researches both electricity and chemistry come into play simply as means of exploration.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

HEREDITARY DEAFNESS. — A STUDY.

THE American Asylum is the oldest school for deaf-mutes in the United States. Its history covers three-quarters of a century. It has had under instruction, including those now in school, 2,459 pupils, a number exceeded by that of but one other school in this country. There have been nearly six hundred marriages, in which one or both of those making the marriage contract were once pupils in the school, and the offspring of these marriages number over eight hundred children. The records of the school have been carefully preserved, and from these and much personal inquiry we have been able to gather some facts which will be interesting at this time, when the question of hereditary deafness is receiving so much public attention. It will be seen at a glance that the field is a favorable one for the study of this subject, and, though not broad enough to warrant the drawing of general conclusions therefrom, the facts are valuable pointers, and may serve as one of the studies, which, when collated, will give sufficient data to work out a general law.

That there is a tendency to deafness in the offspring of congenitally deaf parents, there can be no doubt. Nor can it be doubted that this tendency is comparatively slight in the offspring of parents both of whom are adventitiously deaf. But let the facts speak for themselves. They are believed to be reliable so far as they go; but it is quite probable that in some of the families included in the following table other children may have been born since the dates at which the facts were reported. The general proportion, however, in all probability, would not be affected by such additions. In this table, c. = congenitally deaf; ad. = adventitiously deaf; h. = hearing; u. = age at which deafness occurred unknown.

When we consider how heavy a handicap congenital deafness is, it is appalling to think that 31 per cent of the offspring of the congenitally deaf may be born deaf. But I believe that this proportion is far above that of the general average of such cases throughout the country. I believe that there are causes at work in New England, not in operation to any thing like the same extent in other parts of the country, which will account for no inconsiderable part of the large percentage of congenital deafness in the offspring of congenitally deaf parents in that section.

Facts gathered from the Records of the American Asylum at Hartford, Conn.

	Number of Marriages.	Children Congenitally Deaf.	Children Adventitiously Deaf.	Hearing Children.	Children whether Deaf or Hearing unknown.	Whole Number of Children.	Percentage of Children Congenitally Deaf.
Husband, c.; wife, c....	52	48		88	15	151	31.78
Husband, c.; wife, ad..	37	5	1	74	7	87	5.74
Husband, ad.; wife, c..	51	17		102	5	124	13 70
Husband, ad.; wife, ad.	55	4		129	6	139	3.87
Husband, h.; wife, c...	16	12		52	2	66	18.18
Husband, h.; wife, ad..	5			16	2	18	
Husband, h.; wife, u...	1			4		4	
Husband, c.; wife, h...	26	9		58	5	72	12.50
Husband, ad.; wife, h..	6			13		13	
Husband, ad.; wife, u..	23			43	8	51	.
Husband, u.; wife, u...	2			4	2	6	
Husband, c.; wife, u ..	27	9		58	4	71	12.67
Husband, u.; wife, h...	1			4		4	
Husband, u.; wife, c...	2			4	1	5	
	3[1]						
Sterile..................	283						
Totals.......... ...	590	104	1	649	57	811	12.82

[1] Three families are reported with several hearing children in each.

Of the fifty-two families in which both parents are congenitally deaf, twenty-three have congenitally deaf children.

Of the thirty-seven families in which the husbands are congenitally deaf and the wives adventitiously deaf, two have deaf children,— four in one family, and one in the other.

Of the fifty-one families in which the fathers were adventitiously deaf and the mothers congenitally deaf, seven produced deaf children, and nine of the congenitally deaf children come from two families.

There are fifty-five families in which both parents are adventitiously deaf, and from these have sprung four congenitally deaf children,— one in each of four families.

Four of the sixteen families in which the husbands hear and the wives are congenitally deaf have deaf children.

In five families out of the twenty-six in which the husbands are congenitally deaf and the wives hear, there are children born deaf.

Six of the twenty-seven families in which the husbands were congenitally deaf and the state of the hearing of the wives is unknown produced congenitally deaf children.

Of the twenty-six families in which both parents are deaf and have congenitally deaf children, there are five families in which one of the parents has one deaf parent, seventeen families in which both parents have deaf relatives of the same generation, four in which one parent has deaf relatives

of the same generation, and five in which neither parent has deaf relatives of the same generation.

Of the twenty-six families in which both parents are congenitally deaf and have hearing children only, there is none in which either parent has a deaf parent, so far as reported, twelve families in which both parents have deaf relatives of the same generation, eleven families in which one parent has deaf relatives of the same generation, and three families in which neither parent has deaf relatives of the same generation.

It will be noticed in the table given above that nearly one-half of the marriages are without issue, so far as we have been able to learn. It is probable that in some cases there have been children of whom we have received no account. In other cases the marriages are of recent date. But making due allowance for all these, the proportion of sterile marriages is still very large, much exceeding that in the general population. It is a serious question whether nature alone is responsible for this barrenness.

JOB WILLIAMS.

THE RELATION BETWEEN SCIENTIFIC AND ECONOMIC ENTOMOLOGY.[1]

THE subject of this address is not of the kind usually chosen for similar occasions, but is of none the less interest and importance. It is one, also, that is in full harmony with the genius of this society, which is the recognition of the pre-eminence of what is called the philosophy of science. Another reason makes it of especial immediate importance to us. Economic entomology is upon the verge of an era of great advancement. The establishment of the agricultural experiment stations have added to its ranks more young men of scientific training and ability, perhaps, than have ever engaged in this line of investigation. If economic entomology is but a phase of scientific entomology, then we want to put forth especial efforts to assimilate this young blood in our ranks: if, on the other hand, they are different and distinct, the difference will become more and more apparent as economic entomology develops, and we should define our position as on the side of pure science.

I believe that the pure sciences are distinct from the eco nomic sciences; that this is the primary division of science. We seem to be prone, in this utilitarian age, to try to find excuse for the pursuit of pure science by holding up the possibility of applying our discoveries for economic ends. Let us recognize, and not act as though we were ashamed of, the fact that the sole aim of the student of pure science is the discovery of truth, catering to human wants being entirely out of his province.

It may be said, that, laying aside this matter of sentiment, the human wants are supplied through the discoveries of science, and that this is simply the application of science for economic purposes, or, to put it a little stronger, that economics are but applied sciences. Such a statement comes from the conception that facts are, or in some way become, the peculiar property of a science. This is not the case, however Perhaps, if we could see all the intimate relations sciences have to each other, we should say that every fact belongs to every science; at any rate, we could scarcely name a fact which when closely viewed has not more than one bearing. An example of the far-reaching character of a fact is that of the origin of species through evolution. When Darwin established the truth of this fact, it soon came to be recognized that this basal fact of evolution was a fundamental principle of almost every other science which had occupied the attention of man. For economic purposes it is the facts which are appropriated, and in the same way that the biologist appropriates the facts discovered by the chemist. Economic sciences no more become departments or applications of other sciences by using some of the same facts than biology becomes a department or application of chemistry.

It may be further contended that in the cases cited above we have to do with real sciences, but that the so-called economic sciences have no right to the title of science, that they are essentially different. This will lead us to a consideration of what a science is. We have just seen that it does not consist of a body of facts peculiar to itself; but, on the other hand, it is evident that facts are closely connected with it, that it depends indeed on a set of facts, and, further, that these facts have some definite relation to each other and are susceptible of a rational classification. This classification is not the science, as it cannot express nearly all the relationships, but these relationships do constitute the science. Any one science does not comprehend all the bearings of any fact, but only such as have a relation to that one subject. The science of entomology, for example, consists of the relationship of the facts to insects. The relation of the same facts to the subject of plant-diseases belongs to another science. When the subject is economic, the production of honey, the feeding of stock, or the like, are there any grounds upon which we can refuse it the title of science?

The economic sciences are all infantile, many perhaps not yet even conceived of by man. They are the only true foundation to the useful arts. Agriculture is a science, though hidden by a mass of misconception and empiricism. It must make its advances by the same methods that have made the pure sciences what they are. A clear conception of the object and structure of the science and experimentation with all the conditions under control are essential. Economic entomology as generally understood is chiefly a department of agriculture, but includes much heterogeneous material. To be a scientifically rational term, it must, like some of the genera of the older naturalists, be restricted. I can in no better way show the difference between it and scientific entomology than to indicate the parts of economic entomology, and show where they belong among the economic sciences.

Insects of economic importance may be grouped into six categories: first, those directly injurious to man, which properly forms a department of medicine; second, those attacking the domestic animals, a part of veterinary medicine; third, those injuring cultivated plants, which includes by far the major part of the injurious insects, and to which the term "economic entomology" should be restricted (it is only a part, and perhaps not a natural part, of the science which deals with the diseases of cultivated plants); fourth, those which destroy other property (in this category are the insects attacking furs, woollen goods, etc., and the food-stuffs, which belong to domestic economy and at the same time to commerce; library insects belong to library economy, and so on); fifth, those directly beneficial to man, which includes the bee, the silk-worm, etc.,— industries which form one of the primary divisions of agriculture; sixth, those indirectly beneficial to man by destroying the injurious insects (these insects, of course, belong to the sciences that consider the insects which are their victims).

Finally, to recapitulate, scientific entomology is a depart-

[1] Annual address of the retiring president of the Cambridge Entomological Club, Charles W. Woodworth, Fayetteville, Ark., at its meeting, Jan. 9, 1891 (from Psyche).

ment of biology; economic entomology, of agriculture. They have all the difference between them that there is between a pure science and an economic science. Can we as a society include them both? I think we should not. On the other hand, the economic entomologists are nearly all at the same time scientific entomologists. These we can and do welcome.

AFRICAN AND AMERICAN.

AT a meeting of the Canadian Institute, Toronto, Jan. 24, Mr. D. R. Keys, M.A., read, on behalf of Mr. A. F. Chamberlain, M.A., fellow in Clark University, Worcester, Mass., a valuable and interesting paper entitled "African and American: the Contact of the Negro and the Indian." He said that the history of the negro on the continent of America has been studied from various points of view, but in every case with regard to his contact with the white race. It must therefore be a new as well as an interesting inquiry, when we endeavor to find out what has been the effect of the contact of the foreign African with the native American stocks. Such an investigation must extend its lines of research into questions of physiology, psychology, philology, sociology, and mythology.

The writer took up the history of the African negro in America in connection with the various Indian tribes with whom he has come into contact. He referred to the baseless theories of pre-Columbian negro races in America, citing several of these in illustration. He then took up the question ethnographically, beginning with Canada. The chief contact between African and American in Canada appears to have taken place on one of the Iroquois reservations near Brantford. A few instances have been noticed elsewhere in the various provinces, but they do not appear to have been very numerous. In New England, especially in Massachusetts, considerable miscegenation appears to have taken place, and in some instances it would appear that the Indians were bettered by the admixture of negro blood which they received. The law which held that children of Indian women were born free appears to have favored the taking of Indian wives by negroes.

On Long Island the Montauk and Shinnacook Indians have a large infusion of African blood, dating from the times of slavery in the Northern States. The discovery made by Dr. Brinton, that certain words (numerals) stated by the missionary Pyrlaeus to be Nanticoke Indian were really African (probably obtained from some runaway slave or half-breed), was referred to. In Virginia some little contact of the two races has occurred, and some of the free negroes on the eastern shore of the Chesapeake peninsula show evident traces of Indian blood. The State of Florida was for a long time the home of the Seminoles, who, like the Cherokees, held negroes in slavery. One of their chiefs was said, in 1835, to have had no fewer than one hundred negroes. Here considerable miscegenation has taken place, although the authorities on the subject seem to differ considerably on questions of fact. In the Indian Territory, to which Cherokees, Seminoles, and other Indian tribes of the Atlantic region have been removed, further contact has occurred, and the study of the relations of the Indian and negro in the Indian Territory, when viewed from a sociological standpoint, are of great interest to the student of history and ethnography. The negro is regarded in a different light by different tribes of American aborigines. After mentioning a few isolated instances of contact in other parts of the United States, the writer proceeded to discuss the relations of African and Indian mythology, coming to about the same conclusion as Professor T. Crane, that the Indian has probably borrowed more from the negro than has the negro from the Indian. The paper concluded with calling the attention of the members of the institute to the necessity of obtaining with all possible speed information regarding (1) the results of the intermarriage of Indian and negro, the physiology of the offspring of such unions; (2) the social status of the negro among the various Indian tribes, the Indian as a slaveholder; (3) the influence of Indian upon negro and of negro upon Indian mythology.

DEPOPULATION OF FRANCE.[1]

IT is somewhat startling to find that the depopulation of France is becoming a common subject of discussion among the *savants* of that country. The phrase is perhaps somewhat stronger than the circumstances of the case warrant, the fact being that the population of France is simply stationary. Still it is a striking and significant circumstance, that, while the population of all the other great European nations is steadily and rapidly advancing, that of France remains at a standstill. On economic grounds, this arrest of increase in number might seem not altogether an unmixed evil, inasmuch as it should tend to diminish over-competition, and to ease the already excessive struggle for existence among the lower classes; but an impression widely prevails, that, given a fairly normal and healthy social condition, a growth of population is a natural result, and that a stationary or declining population is an index of some grave disorder of the body politic. We cannot adequately discuss this large and difficult question, but our French neighbors evidently think that something is amiss, and are looking around for the cause and for its remedy. Probably the causes are numerous and complex. Social habits may account for a good deal. The French custom of subdividing land and of providing a dowry for girls offers an obvious motive for keeping down the number of children. Where, as in the west of Ireland, the peasantry have a cheap food-supply, and are constitutionally averse to thrift, large families are the rule; but in France thrift is a virtue carried almost to excess, and the obligation of the parents to provide for each new accession to the family is clearly recognized. Moral causes have been supposed to play a large part in the arrest of the population of France, and we are far from underestimating their importance; but this is a difficult and delicate problem, on which it would be rash to dogmatize without the most ample evidence.

While some of the causes of the phenomenon under discussion may be obscure and remote, others lie under our eyes, and cannot be too carefully scrutinized or too frankly acknowledged. In a recent address before the Académie de Médecine, Dr. Brouardel drew attention to the abnormal mortality from small-pox and typhoid-fever which prevails in France. He points out that while Germany loses only 110 persons per annum from small-pox, France actually loses 14,000. Dr. Brouardel attributes this astounding difference to the rigid way in which vaccination is enforced in Germany, and to the carelessness of his own countrymen in this matter. Statistics show that in 1865, when vaccination was not obligatory in Prussia, the mortality was 27 per 100,000 inhabitants. After vaccination was enforced, the mortality fell in 1874 to 3.60 per 100,000, and in 1886 to 0.049. At the present time the mortality from this cause in France is 43 per 100,000. We make a present of these figures of Dr. Brouardel to the Royal Commission on Vaccination.

As regards typhoid-fever, the deaths due to this disease in France amount to 23,000 per annum. Dr. Brouardel gives a great variety of statistics to show that the liability to typhoid is in direct proportion to the imperfections in the water-supply, and that, in proportion as a sufficient supply of pure water is provided, typhoid abates. Thus, at Vienne the typhoid mortality was 200 per 100,000 while the inhabitants drank surface, hence often polluted, water; but this mortality fell to 10 per 100,000 on a thoroughly good supply being obtained. At Angoulême the introduction of a new supply of pure water reduced the number of cases of typhoid in the proportion of 0.063 to 18. At Amiens, among the military population, the typhoid mortality fell from 111 per 10,000 to 7 when a pure supply of water was secured by artesian wells. At Rennes the inhabitants formerly drank from contaminated wells, with the result that typhoid-fever was always endemic. The introduction of pure water reduced the deaths from typhoid among the military population from 43 per 10,000 to 2. Investigations carried out at Besançon, Tours, Carcassonne, Paris, and Bordeaux entirely corroborate the above striking figures. Typhoid-fever is responsible for the death of 1 soldier in 335 in France, or 298 per 100,000, and this in time of peace. In war its ravages are even far greater. Thus the expeditionary

[1] From the London Lancet, Dec. 20, 1890.

corps to Tunis in 1881, consisting of 20,000 men, had 4,500 cases of typhoid, with 884 deaths.

Dr. Brouardel concludes by affirming that if vaccination and re-vaccination were rendered obligatory in France, and if the towns were everywhere supplied with pure water, the country would save from 25,000 to 30,000 lives annually, and these, for the most part, of young persons of marriageable age. He therefore proposes to the academy to adopt the following conclusions: "that the sanitary law in preparation ought to render vaccination obligatory; it ought to furnish sufficient authority to the municipalities, or in their default the prefect or the government, to secure the public health against the dangers which result from using polluted water."

In the discussion which followed Dr. Brouardel's communication many important points were elicited. One speaker drew attention to the evils which arose from cheap lodging-houses. Another insisted upon the superiority of supplying pure water to any methods of filtration. At Angoulême filtration was tried with some advantage, but the provision of a pure supply proved much more successful.

We may learn something from the anxieties of our neighbors. If the outcry against compulsory vaccination now prevailing in some quarters in this country should unhappily effect any slackening in our vigilance in this matter, we shall surely pay the penalty in a heavier mortality from one of the most loathsome of diseases. The example of Germany in this matter is admirable, and cannot be too widely known or too carefully followed. The provision of an absolutely pure supply of water to our large cities is a much more difficult problem than the thorough enforcement of vaccination, but it is at least the ideal towards which our efforts must be directed. It is an immense gain to know positively both the source of danger and the means of averting it, and we must never rest content so long as an acknowledged source of disease, misery, and national weakness is permitted to exist in our midst.

MEAT-PRESERVATION.

DR. HANS BEU points out that nearly all the newer methods of preparing preserved meats have had to give way before the older methods of boiling, drying, salting, and smoking, which, along with freezing, preserve the taste and digestibility of meats better than any of the chemical methods that have more recently been recommended. As stated in the *British Medical Journal*, all these old methods hinder decomposition, and keep meats eatable for a longer or shorter period. Cold acts by preventing putrefactive changes in meat, 0° to 4° C., with good ventilation, preventing the development of most organisms. Boiling, with subsequent exclusion of air, is, of course, good, but can only be carried out in large establishments and under specially favorable conditions. Drying gets rid of the water, without which micro-organisms cannot develop; but, although there is no loss of albuminoid or salts when this method is used, the taste is somewhat impaired. Salt also acts by removing water, but it also removes the extractives, and interferes with the delicate flavor of both meat and fish. Smoke acts partly by drying, the heat at which it is generated rendering this necessary, but partly, also, by the action of the small quantities of the antifermentative constituents, such as creosote, carbolic acid, and even volatile oils, which appear to have a direct action on the vitality of putrefactive organisms.

The author agrees with Förster, that salt has little or no effect upon most pathogenic organisms, but it undoubtedly interferes with the development of the cholera bacillus and of anthrax bacillus that contains no spores, and probably, also, of some of the non-pathogenic but putrefactive forms.

As the result of his experiments on a very large number of food-materials, such as ham, bacon, pork, various kinds of sausages, and fish, Beu comes to the conclusion that most meats are salted not only to preserve the taste, but also to withdraw a large proportion of the water from flesh; that smoking also withdraws a considerable quantity of water, that it hides the salty taste, and that, being able to penetrate dried flesh, it is better able to exert its antiputrefactive action than on fresh meat. Salted lean flesh, exposed to the action of smoke at from 22° to 25° C. for forty-eight hours, no longer contained liquefying organisms, which had been present in considerable numbers before the smoking operation was commenced, but non-liquefying organisms disappeared only on the ninth day of smoking. Salt bacon salted for ten days, and then exposed to the action of smoke for forty-eight hours, also showed no liquefying organisms with a fragment from near the centre taken with the most strict precautions, and broken up in liquid gelatine, which was afterwards allowed to solidify. All non-liquefying organisms had disappeared on the seventh day of smoking. Bacon salted for five weeks contained no organisms after seven days' smoking. Fresh unsalted meat contained both kinds after six days of smoking, and sausage also contained both at the end of twelve days; this being exactly in accordance with what would be expected from the large amount of water that it contained, from the nature of the meat used, and from the many manipulative processes through which it has to go before the smoking is commenced. Fish may be preserved for a short time by smoking only, but it could not be kept permanently. Hams and larger sausages require a longer period of smoking than do similar smaller articles of diet.

THE MAHOGANY TRADE OF HONDURAS.[1]

THE Republic of Honduras, as well as the territory known as British Honduras, have long been celebrated for their forests of mahogany and other fine-grained woods. Belize, the capital of the British possessions in Central America, now a city of considerable commercial importance, owes, says the United States consul at Ruatan, its origin and wealth to the mahogany-cutters. During the first half of the present century, princely fortunes were quickly accumulated in the business; but, since iron and steel have taken the place of wood in the construction of vessels, the mahogany trade has decreased to a notable extent, although it is still large and profitable. The mahogany cuttings of British Honduras require at present more capital to carry them on than formerly. The expense and difficulty of getting out the wood has greatly increased, as but comparatively few trees can now be found near to the banks of rivers and streams of sufficient depth of water to float the logs to the coast. In Spanish Honduras, and especially within the limits of the consular district of Ruatan, there are still forests abounding in mahogany and other precious woods, where foreign industry and capital might be safely and profitably employed.

The following is the system employed in manipulating the mahogany and in felling the trees, and in hewing, hauling, rafting, and embarking the logs in Honduras. Having selected and secured a suitable locality, and arranged with one of the exporting-houses of Belize to advance the means in provisions and money to carry on the works, the mahogany-cutter hires his gang of laborers for the season. Nearly all labor contracts are made during the Christmas holidays, as the gangs from the mahogany-works all congregate in Belize at that period. The men are hired for a year, at wages varying from twelve to twenty dollars a month. They generally receive six months' wages in advance, one-half of which is paid in goods from the house which furnishes the capital. The cash received by the laborers is mostly wasted in dissipation before they leave the city. Early in January the works are commenced. Camps, or "banks" as they are called, are organized at convenient places on the margin of some river in the district to be worked. Temporary houses, thatched with palm-leaves, are erected for the laborers, and a substantial building for the store aad dwelling of the overseer. The workmen are divided into gangs, and a captain appointed over each gang, whose principal duty is to give each man his daily task, and see that the same is properly done.

All work in mahogany-cutting is done by tasks. The best laborers are out at daybreak, and generally finish their task before eleven o'clock. The rest of the day can be spent in fishing, hunting, collecting India-rubber and sarsaparilla, or in working up mahogany into dories, paddles, bowls, etc., for all of which a ready market is found. The mahogany-tree hunter is the best paid and the most important laborer in the service. Upon

[1] From the Journal of the Society of Arts, London.

his skill and activity largely depends the success of the season. Mahogany-trees do not grow in clumps and clusters, but are scattered promiscuously through the forests, and hidden in a dense growth of underbrush, vines, and creepers. It requires a skilful and experienced woodsman to find them. No one can make any progress in a tropical forest without the aid of a *macheté*, or heavy bush-knife. He has to cut his way step by step. The mahogany is one of the largest and tallest of trees. The hunter seeks the highest ground, climbs to the top of the highest tree, and surveys the surrounding country. His practised eye detects the mahogany by its peculiar foliage. He counts the trees within the scope of his vision, notes directions and distances, then descends and cuts a narrow trail to each tree, which he carefully marks, especially if there is a rival hunter in the vicinity. The axe-men follow the hunter, and after them go the sawyers and hewers.

To fell a mahogany-tree is one day's task for two men. On account of the wide spurs which project from the trunk at its base, scaffolds have to be erected and the tree cut off above the spurs, which leaves a stump from ten to fifteen feet high. While the work of felling and hewing is in progress, other gangs are employed in making roads and bridges, over which the logs are to be hauled to the river. One wide truck pass, as it is called, is made through the centre of the district occupied by the works, and branch roads are opened from the main avenue to each tree.

The trucks employed are clumsy and antiquated contrivances. The wheels are of solid wood, made by sawing off the end of a log and fitting iron boxes in the centre. The oxen which draw these trucks are fed on the leaves and twigs of the bread nut tree, which gives them more strength and power of endurance than any other obtainable food. Mahogany-trees give each from two to five logs ten to eighteen feet long, and from twenty to forty-four inches in diameter after being hewed. The trucking is done in the dry season, and the logs collected on the bank of the river, and made ready for the floods, which occur on the largest rivers in June and July, and on all in October and November. The logs are turned adrift loose, and caught by booms. Indians and Caribs follow the logs down the river to release those which are caught by fallen trees or other obstacles in the river.

The manufacturing process consists in sawing off the log-ends which have beeen bruised and splintered by rocks in the transit down the river, and in re-lining and re-hewing the logs by skilful workmen, who give them a smooth and even surface. The logs are then measured, rolled back into the water at the mouth of the river, and made into rafts to be taken to the vessel, which is anchored outside the bar. The building of sloops and small schooners for the coasting trade is an important industry in the island. The frames of such vessels are made of mahogany, Santa Maria, and other native woods of well-tested durability, and proof against the ravages of worms, which abound in the waters.

At present the only woods exported from Honduras are mahogany and cedar wood, although the forests abound in other varieties, which Consul Burchard states are quite as useful and ornamental, and which must eventually become known in foreign markets, and open "new and inviting fields for industry and trade."

CANADIAN SOCIETY OF CIVIL ENGINEERS.

THE fifth annual meeting of the Canadian Society of Civil Engineers was held in Montreal on Jan. 15, when Col. Sir Casimir Gzowski, A.D.C., was re-elected president for the third time. In consequence of ill health he was unable to deliver the usual set address, but in a short speech he congratulated the society upon the continued and steady progress which it was making, stating that it already occupied a position which its sister society in the United States had not reached in the first decade of its existence.

The total number on the list now includes 633 members, associates, and students, and many original papers of engineering value have already been printed. It was also announced that the president had endowed a silver medal to be awarded annually for the best paper submitted during the year, provided such paper shall be adjudged of sufficient merit as a contribution to the literature of the profession of civil engineering. The first of these medals has been awarded to Mr. E. Vautelet for his paper on "Bridge Strains."

During the past year the society has moved from the rooms generously lent by the University of McGill College to more commodious quarters specially fitted up for their accommodation, and centrally located on St. Catherines Street, near the Windsor Hotel.

The principal papers discussed by the society during the past year are the following: "The Screening of Soft Coal," by J. S. McLennan; "The Manufacture of Natural Cement," by M. J. Butler; "Columns," by C. F. Findlay; "Irrigation in British Columbia," by E. Mohun; "The Sault Ste. Marie Bridge," by G. H. Massey; "Generation and Distribution of Electricity for Light and Power," by A. J. Lawson; "Developments in Telegraphy," by D. H. Keeley; "Errors of Levels and Levelling," Parts 1 and 2, by Professor C. H. McLeod.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Rain Formation.

IT will probably be readily admitted that one of the most complex problems in meteorology is the explanation of the condensation of vapor into visible drops. Cloud has been formed in a receiver by cooling saturated air very rapidly, but it is doubtful whether actual raindrops have been formed artificially. One of the most serious difficulties encountered in studying the problem has been the fact that our observations have been made mostly several thousand feet below the point of formation of the raindrop. Observations on mountain tops have shown a great increase in precipitation above that at the base; for example, the rainfall on Mount Washington (6,279 feet) is double that at Portland, Me., though the latter station is on the seacoast. In September, 1880, the precipitation was 15.23 inches and 3.20 inches, and for the year ending June 30, 1880, 97.10 inches and 45.02 inches, at the two stations respectively. An explanation of this apparent anomaly might aid in solving the general problem before us.

It has been held by some that the rocks and earth at the top of the mountain are colder than the air which blows over it, and for this reason there is the greater condensation at the summit; but it has been proved that the rocks on Mount Washington are several degrees warmer than the air, so that this explanation will not hold. Others have thought that warm saturated air, as it is forced up the side of the mountain, is very much cooled by expansion, and this cooling produces the increased precipitation. This does not hold, however, in the case of Mount Washington, because the top rises up like a sharp cone, and the increased rainfall covers an area many times greater than can possibly be affected in this way. I think it will be admitted that a large share of the precipitation on our mountains is formed within a few hundred feet of the top, in a vertical direction. If so, it would seem that we have here a most excellent opportunity for studying this problem.

There have been published recently, by Harvard College, a complete set of the observations made by the Signal Office at Pike's Peak (14,134 feet), from 1874 to June, 1888, and these are now in a most convenient form for study. It has occurred to me that a valuable addition to our knowledge of the conditions under which precipitation occurs might be made by studying the connection, if any existed, between the temperature fluctuations and precipitation at this elevated point. The usual view is, that a column of saturated air in which moisture is forming into drops or snowflakes is warmer than the air all about at the same level, and for this reason it has a tendency upward. We may put this in another form: if we pass into a column of air in which rain is falling, we shall find the temperature steadily increasing from the circumference to the centre; or, if we take the second interpretation just given for the increased rainfall at the summit of a

mountain, a warm saturated air is continually rushing up the side of the mountain, and the temperature must necessarily rise as long as the rain is formed.

I have projected in curves all the temperature observations at Pike's Peak for the hundred and thirty-six months during which at least .75 of an inch of rain fell. There were thirty-eight months, in all, in each of which less than that amount fell. A very slight diurnal range was eliminated in the manner already indicated many times. Then the precipitation for each eight hours was placed upon the curve of temperature, and the condition of the temperature and precipitation was taken out under three heads,— first with rising, second with stationary, third with falling, temperature. The results for each month are given in the following table:—

Pike's Peak Precipitation and Temperature.

	TEMPERATURE.					
	Rising.		Stationary.		Falling.	
	Total Inches.	Per Cent.	Total Inches.	Per Cent.	Total Inches.	Per Cent.
January	3.38	16	4.05	20	13 40	64
February	3.22	17	4.92	27	10.27	56
March	5.24	17	6.17	20	19.31	63
April	13.84	25	16.17	29	26.13	46
May	14.68	27	20.11	37	19.98	36
June	7.11	27	6.53	25	12.66	48
July	17.48	28	16.05	26	28.49	46
August	10.38	19	15.32	28	29.19	53
September	4.48	20	5.37	24	12.69	56
October	4.41	24	4 63	26	9.09	50
November	4 29	17	6.88	27	14.34	56
December	3.09	17	3.11	17	12.26	66
Year	91.60	22	109.31	27	207.81	51

No one can be more surprised than the present writer at this extraordinary result, so contrary to all preconceived theories. We find that on the average more than half the rain occurs with a falling temperature. It seems probable, however, that in general the rain is independent of the temperature. While it might be thought that a falling temperature in a saturated air would tend to produce precipitation, yet such is by no means the fact. There are many cases in which a fall of from ten to fifteen degrees Fahrenheit has occurred in a saturated air without any corresponding rainfall. Whatever may be thought of these facts, there is one point that is certainly made perfectly clear in this discussion, and that is that the temperature in a column of air in which rain is falling is not *higher* than that of the surrounding region.

It is probable that some will think there is a contradiction between the results here presented and those given several times before, especially in this journal for Sept. 5, 1890, but I think this is only a seeming contradiction. While the great bulk of the rain in the eastern part of the country occurs with a rising temperature at the earth's surface, yet I have shown, that, during the passage of storms and high areas, the temperature in the upper air changes several hours earlier than at the earth (in the case of Mount Washington five to ten hours earlier); so that there may easily be a falling temperature where the rain is formed. Several months of observations at Mount Washington have shown practically the same result as at Pike's Peak.

For several years I have contended that there is absolutely no proof of an ascending current in the centre of our storms, or even where rain is falling. It seems as though the present discussion must be regarded as a culminating point, and a perfectly satisfactory disproof of such ascending current. H. A. HAZEN.

Washington, Jan. 26.

BOOK-REVIEWS.

Socialism New and Old. By WILLIAM GRAHAM. (International Scientific Series.) New York, Appleton. 12°.

THIS is an interesting work. It is written in a more attractive style than that of most economic treatises, and bears the marks of study and thought as well as of a philanthropic spirit. It opens with a statement of what socialism is, its various forms being recognized and defined, with special attention to what is now the leading form of it, that known as collectivism, or nationalism, according to which the State is to be the owner of all the instruments of production, while private property in other things is to remain undisturbed. The author then sketches the history of socialism with special reference to the evolution of the contemporary forms of it, and showing the various contributions of Rousseau, St. Simon, Marx, and others to the doctrine as it is today. He then goes into an elaborate discussion and criticism of the proposed socialistic or collectivist state, pointing out the respects in which it would be sure to fail, as well as others in which its success would be very doubtful. The main objection he makes, and one that he rightly deems insurmountable, is the impossibility of determining the relative rates of wages of the different classes of workers in the socialistic state. He has no difficulty in showing that equality of payment would be impracticable, since the more skilful workmen and the abler managers could not be induced to put forth their best efforts except for relatively higher pay; while, on the other hand, there is no possible way to determine how much higher the pay ought in justice to be. Other objections, such as the impossibility of applying the collectivist scheme to foreign trade, the lack of personal liberty under a socialistic *régime*, and the difficulty of providing for intellectual workers, are also emphasized; and the conclusion is that the attempt to introduce the system "would bring chaos, and 'confusion worse confounded,' until human nature rose in revolt against the impossible thing."

But while Mr. Graham is no collectivist, he maintains that the condition of the laboring classes can be bettered, and ought to be bettered, and that the State ought to do it; yet he seems at a loss with regard to the means. He has some chapters on "practicable socialism," in which he advocates several measures of a more or less socialistic character, such as State loans to co-operative societies, allotments of land to laborers, and purchase of city lands by the municipalities, all more or less objectionable, and, as it seems to us, promising but little real benefit to the poor. Mr. Graham, in short, is more successful as a critic of socialism than as a constructive social reformer; the most useful suggestion he makes being that of giving all classes the means of getting a good education in order to equalize opportunities,— a suggestion, however that is not new. In his last chapter he discusses the supposed present tendency toward socialism, expressing the opinion that such tendency is overrated, and that counter tendencies are at work which will nullify the socialistic movement. Altogether, Mr. Graham has given us a useful discussion, and one that deserves to be read by all who are interested in the subject.

AMONG THE PUBLISHERS.

HENRY HOLT & CO. have just ready "Told After Supper," a series of brief burlesque ghost-stories by Jerome K. Jerome. Although represented as told in good faith by their narrators, the reader is sometimes let into a hint of realistic explanation which gives the touch of good-natured satire characteristic of the author.

— Benjamin R. Tucker, Boston, has just ready "Church and State," a new volume of essays on social problems, by Count Leo Tolstoi, translated directly from Tolstoi's manuscript. It was written several years ago, but has thus far been kept in manuscript.

— Roberts Brothers will publish Feb. 10 the following: "Petrarch, his Life and Works," by May Alden Ward (author of a similar work on Dante), a clear and well-written sketch, in which the subject is considered as the precursor of the Renaissance, and as one of the great triumvirate that created the Italian language and inaugurated its literature; and a volume entitled "Power through

Repose," by Annie Payson Call, who treats of such subjects as training for rest, rest in sleep, the body's guidance, training of the mind, etc.

— Macmillan & Co. announce an edition of Lock's well-known "Arithmetic," revised and adapted for the use of American schools by Professor C. A. Scott of Bryn Mawr College, Pennsylvania.

— The Stefanite aluminum process aims at introducing aluminum into iron, either in the blast-furnace, the cupola, or the puddling-furnace. During the process of manufacture, the liberation of the aluminum from its ores goes on concurrently with the manufacture or melting of the iron, the newly formed metal being instantly alloyed with the iron. It is well known that a minute percentage of aluminum has the effect of lowering the melting-point of iron and steel, rendering it extremely fluid, so that it can be run with great facility without blow-holes. The cost of the process has hitherto rendered its adoption very slow, in spite of the great economies which have been effected by the various electric and electrolytic processes for the production of aluminum. It is with the intention of reducing this cost that the Stefanite process is being introduced. It is not in actual operation in this country, the trials which have already been made having been conducted in Germany. As communicated to *Engineering*, the method of operation consists in the addition to the iron ore in the blast-furnace, or to the pig in the cupola, of emery and alum, either in powder or made up into briquettes. It is stated that the re-action of the alum on the emery gives rise to vapors of metallic aluminum, which instantly alloy themselves with the iron, imparting to it the improved qualities which have hitherto been gained by the addition of aluminum or ferro-aluminum in the ladle or the crucible. The subsequent blowing does not volatilize the aluminum which descends with the iron. When the materials are added in the puddling-furnace, the bars, we are informed, can be hardened and tempered like steel, while their tensile strength is increased. The invention is in the hands of Mr. Thompson Freeman, of 2 Victoria Mansions, Westminster, London, England.

— "Nature's Wonder Workers" is the title of some short life-histories in the insect world, by Kate R. Lovell, which the Cassell Publishing Company have ready. In this book the author's aim is to interest the reader in what are called the "useless insects."

— "Supposed Tendencies to Socialism" is the title of the article that will open the March *Popular Science Monthly*. It is by Professor William Graham of Belfast, who gives his reasons for expecting a progressive improvement in the state of society, but no sudden social transformation. "Iron-Working with Machine-Tools" will be the special topic of an article in the American Industries Series. ' This division of the series is to conclude with an account of the steel-manufacture. In the tariff discussions of recent years, sisal has been one of the articles most frequently mentioned. How it is produced and what it looks like may be learned from the illustrated article on "Cultivation of Sisal in the Bahamas," by Dr. John I. Northrop. One of several articles announced for the same number of the *Popular Science Monthly* is an explanation of Dr. Koch's method of treating consumption, by Dr. G. A. Heron, a London physician, and a friend of the discoverer. An explanation of the real nature of Voodoo, traces of which are found among the negroes in our Southen States, with a description of the strange and wild ceremonies connected with it, will also appear in this number. The writer, Hon. Major A. B. Ellis, is an officer in the British Army.

— "Bibliotheca Polytechnica," a directory of technical literature, is a classified catalogue of all books, annuals, and journals published in America, England, France, and Germany, including their relation to legislation, hygiene, and daily life. It is edited by Fritz von Szczepanski. The first-annual issue of this new international index to the progress of technical science has appeared

Publications received at Editor's Office, Jan. 19–31.

BARDEEN, C. W. Effect of the College Preparatory High School upon Attendance and Scholarship in the Lower Grades Syracuse, N. Y., Bardeen. 5 p. 8°.

BIRNBAUM, Max, Prof. Koch's Method to cure Tuberculosis popularly treated by. Tr. by Dr. Fr. Brendecke. Milwaukee, Wis., H. A. Haferkorn. 106 p. 12°.

BROOKLYN Daily Eagle Almanac, 1891. Brooklyn, Daily Eagle Pr. 296 p. 8°. 25 cents.

GRAHAM, W. Socialism New and Old. New York, Appleton. 416 p. 12°.

HARRIS, W. T. Hegel's Logic. Chicago, Griggs. 403 p. 16°. $1 50.

HEWITT, W. Elementary Science Lessons. Standard I. London and New York, Longmans, Green, & Co. 115 p. 16°. 50 cents.

HEYDENFELDT, S., Jr. The Unison of the Conscious Force. New York, J. J. Little, Pr. 105 p. 8°.

HOOGEWERFF, J. A. Magnetic Observations at the United States Naval Observatory, 1888 and 1889. Washington, Government. 100 p 4°.

INGERSOLL, R. G. Liberty in Literature. Testimonial to Walt Whitman. New York, Truth Seeker Co. 77 p. 12° 50 cents.

LEFFMANN, H., and BEAM, W. Examination of Water for Sanitary and Technical Purposes. 2d ed. Philadelphia, Blakiston. 180 p. 12°.

LODGE, G., *ed.* Plato Gorgias. Boston, Ginn. 308 p. 12°. $1.75.

MARINE Biological Laboratory of Wood's Holl, Biological Lectures delivered at the, in the Summer Session of 1890. Boston, Ginn. 250 p. 12°.

MAXWELL, W. H. Examinations as Tests for Promotion. Syracuse, N. Y., Bardeen. 11 p. 8°.

MICHIGAN, Laws of the State of, relating to the Public Health, in Force in the Year 1890. Lansing, State. 175 p. 8°.

MISSOURI, Biennial Message of Gov. David R. Francis to the Thirty-sixth General Assembly of the State of. Jefferson City, State. 42 p. 8°.

NEW YORK Institution for the Blind, Fifty-fifth Annual Report of the Managers of the, for the Year ending Sept. 30, 1890. Albany, State. 77 p. 8°.

PENNSYLVANIA Oral School for the Deaf, Scranton, Fifth Report of the, for the Years 1888–89, 1889–90. Scranton, F. F. Schoen, pr. 27 p. 8°.

ROHÉ, G. H. Text-Book of Hygiene. 2d ed. Philadelphia and London, F. A. Davis. 421 p. 8°. $2.50.

SABIN, H. Organization and System *vs.* Originality and Individuality on the Part of Teacher and Pupil. Syracuse, N. Y., Bardeen. 9 p. 8°.

SCRIBNER'S MAGAZINE, Comics from. New York, Scribner. 8°. 10 cents.

SOLDAN, F. L. Tiedemann's Record of Infant-Life. Syracuse, N. Y., Bardeen. 46 p. 16°.

TERRY, J. Sculptured Anthropoid Ape Heads. New York, Amer. Mus. Nat. Hist. 15 p. f°.

THOMPSON, S. P. Lectures on the Electromagnet. New York, W J. Johnston Co. 287 p. 12°.

U. S. GEOLOGICAL SURVEY. Topographical Map of the United States. Washington, Government. 9 sheets. f°.

——Topographical Maps of Portions of New Jersey, Pennsylvania, Delaware, Maine, New Hampshire, Wisconsin. Washington, Government. 12 maps. f°.

(New York, The International News Company). The catch-words are given in three languages,— English, French, and German,— so that readers of every nationality can at once turn to the branch he seeks in the literature of the latest investigations. An exhaustive enumeration of the technical journals in the three languages is also given.

— We learn from the *Journal of Economics* that a new serial publication devoted to economic discussion is about to appear in England as the organ of the newly founded British Economic Association. The association was organized in November last, with Mr. Goschen as president, and other men of eminence in the economic world in the other offices. The aim of the association is to promote economic study and discussion by all the means usually employed by such societies, but more particularly through the medium of the new journal, the first number of which will appear in March. It will not be the mouthpiece of any one school, but will welcome contributions from any writer who is master of his subject. In view of the prominence of English writers in the development of economic science, it is a little strange that such a movement has not been made by them before; but, now that it has been started, it can hardly fail to be important. There is also to be another periodical issued in England, called the *Economic Review*, which will deal with economic subjects in their moral and social aspects, and which will number among its contributors both English and American writers. The appearance of the new journals will be awaited with interest.

— In October last appeared the first number of the *International Journal of Ethics*, published in Philadelphia and London, and edited by a committee consisting of Americans, Englishmen, and Germans. It is the successor of the *Ethical Record*, which was an organ of the ethical societies; but the new magazine is of a broader character, and devoted to the discussion of all ethical subjects, both theoretical and practical, without being an organ of any movement or opinion whatever. The first number was of a high order, the papers by Messrs. Sidgwick, Adler, and Höffding being especially suggestive, and the whole magazine giving excellent promise for the future. The January issue, however, is not so good, and contains some of those superficial and half-digested essays which are nowadays all too common. It opens with a well-considered article by Professor D. G. Ritchie, on "The Rights of Minorities," in which the writer maintains that the essential right of minorities is that of freely inculcating their views so as to persuade other people to adopt them, thus converting the minority into a majority. Next follow a review of Professor James's "Psychology," by Josiah Royce; an article on "The Inner Life in Relation to Morality," by J. H. Muirhead; and others on "Moral Theory and Practice," by John Dewey, and on "Morals in History," by Fr. Jodl; but none of these can be said to carry much weight. "The Ethics of Doubt," by W. L. Sheldon, is a thoughtful paper on Cardinal Newman, and some of the lessons of his life and career. Mr. F. H. Giddings has a brief article on "The Ethics of Socialism," and there is an interesting account by Mrs. M. McCallum of the ethical societies of Great Britain. On the whole, there is promise of much good in the new journal; but its conductors must maintain a high standard, and require thorough workmanship on the part of their contributors, if it is to hold the place that it ought to hold in the periodical literature of the time. The journal is published at 1602 Chestnut Street, Philadelphia, at two dollars a year.

SCIENCE

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NINTH YEAR.
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$3.50 PER YEAR, IN ADVANCE.

CALENDAR OF SOCIETIES.

Anthropological Society, Washington.

Feb. 8.—L. R. Klemm, City Life in the Middle Ages; Robert Fletcher, The Indian Messiah; W. H. Holmes, An Engraved Tablet from Tennessee.

Biological Society, Washington.

Feb. 7.—C. D. Walcott, Discovery of Vertebrate Life in Lower Silurian (Ordovician) Strata; Henry F. Osborn, A Review of the Discovery of the Cretaceous Mammalia.

New York Academy of Sciences.

Feb. 9.—A. R. Ledoux, Notes on a Visit to the Sweet Grass Hills of Montana, and Kootenai Lake, British Columbia; A. R. Leeds, The Precipitation of Suspended Silt and Clay in River Waters, and The Discovery of a Starch-Digesting Ferment in Cow's Milk, and its Relation to Nutrition.

Feb. 16.—Wallace Goold Levison, Instantaneous Photography as an Aid to Science, History, and Art (illustrated by novel lantern views).

Appalachian Mountain Club, Boston.

Feb. 11.—Roseweli B. Lawrence, The Carolina Mountains.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—A young man in college would like a position during the summer of 1891 in some scientific work, particularly Orinthology, either as an instructor or tutor, or in making collections or accompanying some scientific expedition. Can give good references. Address HUBERT L. CLARK, Amherst, Mass.

WANTED.—A young man who has been teaching in a first-class High School desires a position in a similar institution. Is competent to teach Mathematics, Latin, Book-keeping, and the English branches. Can give highest references Address H. W. MARTHENS, 6208 Broad St., Pittsburgh, Pa.

WANTED.—A situation in a scientific house by a graduate of the scientific department of the Jersey City High School as Geologist, Mineralogist or as assistant teacher in Physics or assistant to a chemist. Best of references. E. W. PERRY, 582 Third Street, Jersey City, N. J.

WANTED.—By a medical student of three courses, a position on some war or mercantile vessel sailing between America and some foreign country, as Clerk, Assistant Physician or Druggist, or any respectable occupation. Content with a moderate remuneration. Highest commendations. W. L. S., *Science* Office.

INFORMATION WANTED.—Clarence W. Bowen, Secretary of the Committee on the Centennial of Washington's Inauguration, 251 Broadway, New York, desires information regarding the portraits of John Hathorn and Jeremiah Van Rensselaer, members of Congress from New York. These portraits, for the Memorial Volume, are particularly desired, to complete the list of portraits of the New York delegation in Congress at the time of Washington's inauguration.

WANTED. — One first-class instrument-maker. Apply by letter to T. C. MENDENHALL, Superintendent U. S. Coast and Geodetic Survey, Washington, D. C

WANTED.—An Entomologist to accompany a camping party of boys during July next. Address, stating experience and salary expected, ALBERT L. AREY, Free Academy, Rochester, N.Y.

WANTED.—A young man wishes a position in an experiment station. botanical department preferred. References and evidence of competency on application. Address E. E. BOGUE. Agr. Experiment Station, Columbus, O.

WANTED—Employment or partial employment as naturalist collector for all Ornithological, Entomological or Zoological specimens. First class Canadian references supplied. Would be willing to work in Canada or any part of America as desired. Salary or commission. G. E. ATKINSON, 639 Spadina Ave., Toronto, Can.

A UNIVERSITY GRADUATE IN SCIENCE, at present a junior student in medicine at the University of Michigan, desires a position as teacher or laboratory assistant. Special preparation in Zoology, Histology, Physiology and Human Anatomy. Will also teach, if desired, Physics, Chemistry, Botany, Entomology, Embryology, Bacteriology and Sanitary Science. References and full particulars on application. H. B., 20 East Jefferson St., Ann Arbor, Mich.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

I have a good supply of Eastern Coleoptera which I wish to exchange for species not in my collection. Melandryidae and Oedemeridae especially desired. Joe C. Thompson, Rosebank P. O., Box 73, S. I.

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1890 Seeger and Guernsey Cyclopedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost $6. David R. Lewis, Saybrook, Ill.

SCIENCE

NEW YORK, FEBRUARY 13, 1891.

AFRICAN AND AMERICAN: THE CONTACT OF NEGRO AND INDIAN.[1]

THE history of the negro on the continent of America has been studied from various points of view, but in every instance with regard alone to his contact with the white race. It must be, therefore, a new, as well as an interesting, inquiry, when we endeavor to ascertain what has been the effect of the contact of the foreign African with the native American stocks. Such an investigation, to be of great scientific value, in the highest sense, must extend its lines of research into questions of physical anthropology, philology, mythology, sociology, and lay before us the facts which alone can be of use. So little attention has been paid to our subject, in all its branches, that it is to be feared that very much of great importance can never be ascertained; but it is the object of this essay to indicate what we already know, and to point out some questions concerning which, with the exercise of proper care, valuable data may even yet be obtained.

It is believed that the first African negro was introduced to the West Indies between the years 1501 and 1503; and since that time, according to Professor N. S. Shaler,[2] there have been brought across the Atlantic not more than "three million souls, of whom the greater part were doubtless taken to the West Indies and Brazil." Professor Shaler goes on to say, "It seems tolerably certain that into the region north of the Gulf of Mexico not more than half a million were imported. We are even more at a loss to ascertain the present number of negroes in these continents: in fact, this point is probably indeterminable, for the reason that the African blood has commingled with that of the European settlers and the aborigines in an incalculable manner. Counting as negroes, however, all who share in the proportion of more than one-half the African blood, there are probably not less than thirty million people who may be regarded as of this race between Canada and Patagonia." Such being the case, the importance of the question included in the programme of investigation of the Congrès des Américanistes — "Pénétration des races africaines en Amérique, et spécialement dans l'Amérique du Sud" — becomes apparent, and no insignificant part of it is concerned with the relations of the African and the native American.

It was said that we start with 1503 or thereabouts. Of course, some imaginative minds have discovered negroes in America at a period long antedating this; but such is theory, not fact. What the curious sculptured faces in Central American ruins signify, we cannot at present determine. Enthusiastic missionaries have spoken of negroes in Labrador,[3] and Peter Martyr (third decade) tells of negroes taken prisoners in the battle between the Spaniards and Quaragua in 1513. He states,[4] "About two days' journey distant from Quaragua is a region inhabited only by black Moors sailed thither out of Ethiopia, to rob, and that by shipwreck, or some other chance, they were driven to these mountains." Washington Irving thinks that Martyr was retailing the "mere rumor of the day," and, as other historians do not refer to the subject, considers that the belief "must have arisen from some misrepresentation, and is not entitled to credit." Fontaine says,[1] "Nunez, in coasting along the shores of the Gulf of Darien, discovered a colony of woolly-headed black people, who had settled among the copper-colored inhabitants of the mainland." This colony, too, must be relegated to the land of fiction and romance. Nor is it the only instance of the kind. Dr. A. R. Wallace states that the Juris of the Rio Negro, who are "pure, straight-haired Indians," are down in some maps as "Juries, curly-haired negroes." And not a little misconception has been caused by such broad statements as that of Col. Galindo:[3] "The Carib is identical in outward appearance with the African negro."

Having thus cleared the way a little, let us take up the consideration of our subject ethnographically. We may begin with Canada. Although the Maroon settlement in Nova Scotia, near Halifax, existed for a number of years (before the removal to Sierra Leone), and remnants of it are still to be found there, there appear to be no records extant attesting contact with the Indian aborigines. Mr. J. C. Hamilton, M.A., LL.B., of Toronto, who has devoted much time to the study of the "African in Canada," is the writer's authority for the statement that on one of the Iroquois reservations in Ontario considerable intermixture with the negro had taken place.[4] This opinion is confirmed by Odjidjatekha, an intelligent Mohawk of Brantford, who states that the Tuscarora reserve near that city is the one in question. It has often been asserted that the celebrated Joseph Brant was a slave-holder; but this has been denied by his friends, who assert that he merely gave shelter to refugee negroes, who were rather in the relation of dependents than of slaves. One frequently comes across passages like the following:[5] "Some Mohawk Indians and a negro of Brant's;" and some such state of affairs would be necessary to account for the present admixture of negro blood. Mr. Hamilton also informed the writer that Mr. George H. Anderson of Toronto, a United States pensioner, and a native of Maryland, claims that his mother's mother was a full-blooded Indian. There is also a case of negro-Indian intermixture reported from British Columbia.

In New England, especially in Massachusetts, considerable intermingling of African and Indian appears to have occurred. The earliest mention of negro slaves in the Bay State is in 1633, and a very curious entry it is. Wood[6] tells

[1] Paper read before the Canadian Institute, Toronto, Jan. 24, 1891, by A. F. Chamberlain, M.A., fellow in anthropology in Clark University, Worcester, Mass.

[2] "The African Element in America" (The Arena, vol. ii. p. 666).

[3] CHARLEVOIX, Hist. et Descript. générale de la Nouvelle France, 1744, pp. 17, 18.

[4] IRVING, Spanish Voyages of Discovery (Lovell's Library, No. 301), p. 120.

[1] How the World was Peopled, p. 163.

[2] A Narrative of Travels on the Amazon, etc. (new ed., London, 1889), p. 355.

[3] Journal of the Royal Geographical Society, vol. iii. 1834, p. 291.

[4] See "The African in Canada" (Proceedings of the American Association for the Advancement of Science, vol. xxxviii., 1889, pp. 364–370); "The Maroons of Jamaica and Nova Scotia" (Proceedings of the Canadian Institute, 3d series, vol. vii. 1890, pp. 260-269); also Transactions of the Canadian Institute, vol. i. (1890–91), p. 107.

[5] Zeisberger's Diary (Ed. Bliss, 1885), p. 316, under date of June, 1798.

[6] New England Prospect (1634), p. 77, cited in WILLIAMS's History of the Negro Race in America, 1883, vol. i. p. 173.

of some Indians who were alarmed at a negro whom they met in the depths of the forest, and "were worse scared than hurt, who seeing a blackamore in the top of a tree, looking out for his way which he had lost, surmised he was *Abamacho* or the devil, deeming all devils that are blacker than themselves, and being near to the plantation, they posted to the English, and entreated them to conjure the devil to his own place, who finding him to be a poor wandering blackamore, conducted him to his master." It is presumable that there were negro slaves in Massachusetts before 1633, and from time to time contact of Indian and negro must have taken place. That the intermarriage of Indian women with negroes was prevalent to a considerable extent in this State seems probable from Williams's[1] remarks upon the decision of Chief Justice Parker: "that the issue of the marriage of a slave husband and a free wife were free."

"This decision is strengthened by the statement of Kendall[2] in reference to the widespread desire of negro slaves to secure free Indian wives in order to insure the freedom of their children. He says, 'While slavery was supposed to be maintainable by law in Massachusetts, there was a particular temptation to negroes for taking Indian wives, the children of Indian women being acknowledged to be free.'"

Professor Shaler, in his interesting article "Science and the African Problem,"[3] thus expresses himself regarding the question in New England: "It is frequently asserted that the remnants of the New England Indians as well as of other Indian tribes have been extensively mixed with African blood. It is likely that in New England, at least, this opinion is well founded, though it is doubtful if the mixture is as great as is commonly assumed to have been the case. The dark color of these Indians, which leads many to suppose that they may have a large inheritance of negro blood, is probably in many cases the native hue of the Indian race. The moral and physical result of this blending of two extremely diverse bloods is a matter of the utmost interest. It may be studied to great advantage in the New England Indians, for among them there has been little in the way of civil or social proscription to affect the result."

In a subsequent essay,[4] Professor Shaler remarks, "I have been unable definitely to trace the existence in this section of any descendants of the blacks who were then there in the last century, save perhaps in the case of a few who have become commingled with the remnants of the Indians of Gay Head and Marshpee. If such there be, they are very few in number."

In the first volume of the "Massachusetts Historical Society Collections"[5] there is a brief account of the Indians of Martha's Vineyard: "In the year 1763 there were remaining in Dukes County 313 Indians, 86 of whom were in Edgartown, 39 in Tilbury, and 188 in Chilmack. About that period they began to intermarry with negroes, in consequence of which the mixed race has increased in numbers, and improved in temperance and industry. At present there are of pure Indians and of the mixed race about 440 persons, 70 of whom live on Chappaquiddick (not more than one-third pure), about 25 at Sanchechecantacket (not more than one-third pure), about 40 at Christiantown in the north part of Tisbury, toward the sound (about one-half pure), about 24 at Nashonohkamuck (about three-quarters pure), and about 276 at Gay Head (of which about one-fourth are pure). In this

[1] History of the Negro Race in America, vol. i. p. 180.
[2] Travels, vol. ii. p. 179.
[3] Atlantic Monthly, vol lxvi. 1890, p. 40, col. 1.
[4] The Arena, vol. ii. p. 666.
[5] Massachusetts Historical Society Collections, 1st series, vol. i. p. 206.

account unmixed negroes are not reckoned." This information is given upon the authority of "Capt. Jerningham and Benj. Basset, Esq."

In Belknap's "Answer to Judge Tucker's Queries" it is stated.[1] "Some negroes are incorporated, and their breed mixed with the Indians of Cape Cod and Martha's Vineyard, and the Indians are said to be meliorated by the mixture."

In Volume III. of the second series, under date of 1802,[2] we find an account of the Indians of Marshpee: "The inhabitants of Marshpee are denominated Indians, but very few of the pure race are left. There are negroes, mulattoes, and Germans. Their numbers have often been taken, and have not varied much during the past twenty years. At present there are about 80 houses and 380 souls." According to an exact census taken in 1808, the Indians, negroes, and mulattoes in Marshpee numbered 357.

In the "History of New Bedford (1858)," by Daniel Ricketson, there is (pp. 253–262) an account of Paul Cuffee, whose mother was "an Indian woman named Ruth Moses." Cuffee was born on Cuttyhunk, one of the Elizabeth Islands, in 1759, and died on his farm at Westport in 1817. His father was a native of Africa, and Cuffee is described as "a man of noble personal appearance, tall, portly and dignified in his bearing. His complexion was not dark, and his hair was straight" (p. 225). At the age of twenty-five Cuffee married a member of his mother's tribe. He was a man of considerable attainments, being a sailor as well as a farmer.

Robert Rantoul, sen., in a paper read before the Beverly Lyceum in April, 1833,[3] says of the negroes, "Some are incorporated with the Indians of Cape Cod and Martha's Vineyard, and the Indians are said to be improved by the mixture." He also states[4] regarding the 6,001 "persons other than white," returned by the United States census of 1790 as resident in Massachusetts (with Maine), that it is supposed the blacks were upwards of 4,000; and of the remaining 2,000 many were a mixed breed between Indians and blacks."

Of the Gay Head Indians, a recent visitor, Mr. W. H. Clark,[5] says, "The Indian reservations present much of interest. The Gay Head Indians, who, since the days of the early settlement of the country, have been friendly to the white men, are an industrious and cleanly people. Although one observes much that betokens the Indian type, the admixture of negro and white blood has materially changed them. A few years ago the Indians were admitted to citizenship, and one of their tribe was elected to the General Assembly of Massachusetts. The women far surpass the men in intelligence and thrift. The Indians earn a livelihood by agriculture, fishing, and as caterers to the tourists who visit Gay Head. Their little restaurants are scrupulously clean and very inviting places, where simple but good meals can be obtained. The number now on the reservation is not far from one hundred and fifty. Many, however, have sought homes for themselves elsewhere." An interesting point in connection with the history of the Indian and negro in Massachusetts is the deportation of the Pequots to the Bermudas[6] after their utter defeat in the disastrous war which closed in 1638. We must also notice the importation of negroes from Barbadoes in exchange for Indians.[7]

[1] Massachusetts Historical Society Collections, 1st series, vol. iv. p. 206 (cf. 2d series, vol. iii. p. 12).
[2] Vol. iii. 1815, p. 4.
[3] Printed in part in Historical Collections of Essex Institute, vol. xxiv. pp. 81–108.
[4] Loc. cit., p. 99.
[5] Johns Hopkins University Circulars, No. 84, December, 1890, p. 28.
[6] WILLIAMS, History of the Negro Race in America, vol. i. pp. 173, 174; DE FOREST, History of the Indians of Connecticut (1852), pp. 117-160.
[7] Massachusetts Historical Society Collections, 1st series, vol. i. p. 206.

With regard to the other New England States, we do not at present possess many data. In De Forest's "History of the Indians of Connecticut," we find the following notices: —

"A few of this clan [the Milford band of the Paugusset or Wepawaug Indians] still [1849] live on about ten acres of land at Turkey Hill. The family name is Hatchett; they are mixed with negro blood; and they are all poor, degraded and miserable" (p. 356). "The tribe [the Golden Hill Paugussets] now [*circa* 1850] numbers two squaws, who live in an irregular connection with negroes, and six half-breed children, all of whom are grown up but one. They are intemperate, but have been of about the same number for many years. Their family name is Sherman" (p. 357).

"In 1832 the Groton Pequots numbered about forty persons of both sexes and all ages. They were considerably mixed with white and negro blood, but still possessed a feeling of clanship, and still preserved their ancient hatred for the Mohegans" (p. 443).

Of the Indians in Ledyard who are idle and given to drink, it is said (p. 445), "None of the pure Pequot race are left, all being mixed with Indians of other tribes or with whites and negroes. One little girl among them has blue eyes and light hair, and her skin is fairer than that of the majority of white persons. There is no such thing as regular marriage amongst them. In numbers they do not increase, and, if any thing, diminish. The community, like all of the same kind in the State, is noted for its wandering propensities, some or other of its members being almost continually on the stroll around Ledyard and the neighboring townships. From a fellow-feeling, therefore, they are extremely hospitable to all vagabonds, receiving without hesitation all that come to them, whether white, mulatto, or negro."

When we arrive at Long Island, we reach another point of miscegenation. Speaking of East-Hampton Town, Mr. William Wallace Tooker says,[1] "In regard to the degenerated remnant of the [Montauk] tribe now residing within the limits of the township, recognized by their characteristic aboriginal features, mixed with negro, we would say that they have no knowledge of their native language, traditions, or customs, all have been lost or forgotten, years ago." Of the Shinnacooks, Professor A. S. Gatschet remarks,[2] "The Shinnacook Indians are a tribe living on the southern shore of Long Island, New York State, where they have a reservation upon a peninsula projecting into Shinnacook Bay. There are 150 individuals now going under this name, but they are nearly all mixed with negro blood, dating from the times of slavery in the Northern States."

Proceeding along the Atlantic coast southward, we reach the region of the Chesapeake before we again meet with definite traces of negro-Indian intermixture. A very interesting discovery of Dr. Brinton's[3] belongs here. In a manuscript of Pyrlæus, the missionary to the Mokawks, dating from 1780, are given the numerals 1–10 in a language styled "Nanticoke." Dr. Brinton, noticing the un-American and non-Algonquian aspect of these words, was led to the conclusion that "Pyrlæus . . . had met a runaway slave among the Nanticokes, and through him, or through some half-Indian half-negro, had obtained a vocabulary of some African dialect." The correctness of this conclusion is seen at a glance from the comparative table of the pseudo-Nanticoke and the Mandingo of Müller given by Dr. Brinton: —

ENGLISH.	PSEUDO-NANTICOKE.	MANDINGO (MULLER).	MALINKE (TAUTIN).
One	Killi	Kilin	Kili
Two	Filli	Fula	Fûla (Fillo, *Soninké*)
Three	Sapo	Sabba	Saba
Four	Nano	Nani	Nani
Five	Turo	Dulu, Lulu	Loulou, Doulou
Six	Woro	Woro	Ouoro, Ouaro
Seven	Wollango	Worong-wula	Oulouñga
Eight	Secki	Segui	Seghi, Saghi
Nine	Collengo	Konanta	Kononto
Ten	Ta	Tang	Tañ

This curious fact that Dr. Brinton has brought to light may perhaps be paralleled by others yet to be discovered in the future, when the whole history of the origin of the various tribes of African immigrants into America comes to be written.

With regard to Virginia, we have the evidence of Peter Kalm,[1] as follows: "In the year 1620, some negroes were brought to North America in a Dutch ship, and in Virginia they bought twenty of them. These are said to have been the first that came hither. When the Indians, who were then more numerous in the country than at present, saw these black people for the first time, they thought they were a true breed of devils, and therefore they called them *Manitto* for a great while, the word in their language signifying not only 'god,' but also 'devil.' . . . But since that time they have entertained less disagreeable notions of the negroes, for at present many live among them, and they even sometimes intermarry, as I myself have seen."

Thomas Jefferson, in his "Notes on the State of Virginia,"[2] says of the Mattapony Indians of that State, "There remains of the Mattaponies three or four men only, and have more negro than Indian blood in them."

Mr. G. A. Townsend[3] observes, concerning the Indians of the Chesapeake Peninsula, "In this [Dorchester] county, at Indian Creek, some of the last Indians of the peninsula struck their wigwams towards the close of the last century, and there are now no full-blooded aborigines on the Eastern shore, although many of the free-born negroes show Indian traces."

Enslavement of negroes by Indians (especially Cherokees) appears to have taken place in several of the South Atlantic States, and it is not unlikely that considerable miscegenation there occurred. Mr. McDonald Furman,[4] in a note on "Negro Slavery among the South Carolina Indians," notes the mention, in the *South Carolina Gazette*, in the year 1748, of a "negro fellow" who had been sold by his former master to the Pedee Indians, from whom he was afterwards taken by the Catawbas; and in endeavoring to escape from the latter he was lost in the woods. This fact is of value in connection with the discovery of Dr. Brinton, referred to above.

In Hancock County, Tenn., there are to be found a peculiar people, who formerly resided in North Carolina. According to Dr. Burnett,[5] the current belief regarding them is that "they were a mixture of the white, Indian, and negro;" but nothing certain appears to be known about them. They

[1] Indian Place-Names in East-Hampton Town, with their Probable Significations (Sag Harbor, 1889), p. iv.

[2] American Antiquarian and Oriental Journal, November, 1889, p. 390.

[3] "On Certain Supposed Nanticoke Words shown to be African" (American Antiquarian and Oriental Journal, 1887, pp. 350–354, especially 352). In the table given above there have been added for further comparison the Malinké numerals as given by Dr. Tautin in the Revue de Linguistique et de Philologie Comparée, vol. xx. (1887), p. 141.

[1] In Pinkerton, vol. xiii. p. 502.

[2] Ed. Philadelphia, 1825, p. 130.

[3] Scribner's Magazine, 1871–72, p. 518.

[4] American Antiquarian and Oriental Journal, vol. xii. p. 177; see also WEST, Status of the Negro in Virginia during the Colonial Period (1890), p. 38.

[5] See "A Note on the Melungeons" (American Anthropologist, vol. ii. pp. 347–349).

bear the curious name of "Melungeons," which, Dr. Burnett suggests, is a corruption of the French *melange* ("mixed").

Figuring prominently as holders of negro slaves, we find the Seminoles of Florida. To cite a single instance: we learn that Mick-e-no-pah, a chief of the Seminoles, who took part in the war of 1835, and whose portrait was painted by Catlin, owned no fewer than one hundred negroes, and raised large crops of corn and cotton. From Cohen[1] we gather the following additional information: "The 'top governor' has two wives, one a very pretty squaw, and the other a half-breed negress. She is the ugliest of all women, and recalls the image of Bombie of the Frizzled Head in Paulding's Koning's works."

William Kennedy, in his "History of Texas,"[2] says regarding the enslavement of negroes by these Indians, "The possession of negroes, by rendering the Indians idle and dependent on slave-labor, has confirmed the defects of their character. The Seminole negroes mostly live separate from their masters, and manage their cattle and crops as they please, giving them a share of the produce. Williams, in his account of Florida, mentions the existence of a law among the Seminoles prohibiting individuals from selling their negroes to white people, any attempt to evade which has always raised great commotions amongst them. The State of Georgia claimed $250,000 of the Creek Indians for runaway slaves. Under cover of these claims, says Williams, many negroes have been removed from their Indian owners by force or fraud. The slaves prefer the comparatively indolent life of the Indian settlements to the sugar and cotton fields of the planter, and the Indian slave-holders are quite satisfied if they are enabled to live without special toil." In the account of Major Long's expedition,[3] we read, concerning the Cherokee settlement at Rocky Bayou, "Our host, a Metiff chief known as Tom Graves, and his wife of aboriginal race, were at table with us, and several slaves of African descent were in waiting. The Cherokees are said to treat their slaves with much lenity."

Marcy[4] informs us that "within the past few years the Comanches have, for what reason I could not learn, taken an inveterate dislike to the negroes, and have massacred several small parties of these who attempted to escape from the Seminoles and cross the plains for the purpose of joining Wild Cat upon the Rio Grande." That the ill feeling was not always upon the side of the Indians, we see from Zeisberger's "Diary" (vol. ii. p. 142), where we learn that two negroes who went from Detroit through the bush killed five Wyandottes whom they came across there.

A mass of information regarding the Seminoles of Florida is to be found in the excellent report of the Rev. Clay McCauley,[5] to the Bureau of Ethnology. From this we learn that at that time there were among these Indians three negroes and seven persons of mixed race, distributed as follows:[6] at Big Cypress settlement, one male of mixed race between five and ten years of age, and one black female over twenty; at Fish-Eating Creek, one male of mixed race under five years of age, one between ten and fifteen, one over twenty, one female of mixed race over twenty, and one black female over twenty; at Catfish Lake, one male and one female of mixed race over twenty years of age, and one black female over twenty. At the Cow Creek and Miami River settlements there appear to be neither negroes nor half-breeds. As regards sex, the numbers are, mixed, females two, males five; black, females three, males none. The only half-breeds are "children of Indian fathers by neresses who have been adopted into the tribe; for, according to Mr. McCauley, the birth of a white half-breed would be followed by the death of the Indian mother at the hands of her own people." Mr. McCauley states that he found nothing to indicate that slavery exists among the Seminoles, "the negresses living apparently on terms of perfect equality."[1] He further expresses the opinion, "The Florida Seminoles, I think, rather offered a place of refuge for fugitive bondsmen, and gradually made them members of their tribe."[1] An interesting account is given of Me-Le, a half-breed Seminole, "son of an Indian, Ho-laq-to mik-ko, by a negress, adopted into the tribe when a child." It is stated that he favors the white man's ways, and is progressive. Particularly noticeable was "his uncropped head of luxuriant, curly hair," an exception to the "singular cut of hair peculiar to the Seminole men."[2] He notes also at the Big Cypress Swamp a small half-breed whose "brilliant wool was twisted into many little sharp cones, which stuck out over his head like so many spikes on an ancient battle-club."[3] The only exception to the usual hair-dressing of females of the tribe was found in the manner "in which Ci-ha-ne, a negress, had disposed of her long crisp tresses. Hers was a veritable Medusa head. A score or more of dangling snaky plaits, hanging down over her black face and shoulders, gave her a most repulsive appearance."[3]

Another article dealing with the Seminoles of Florida is that of Mr. Kirk Munroe,[4] in a recent number of *Scribner's Magazine*. From it we learn, that, "should a Seminole maiden unwisely bestow her affections upon any man outside her tribe, her life would be forfeited." Mr. Munroe states that "there are no half-breeds among the Florida Seminoles,"[5] but notes, however, a case in which a Seminole "took as his wife a comely negro woman, who was captured by the Indians during the Seminole war; but their children are so far from being regarded as equals by other members of the tribe, that no full-blooded Indian will break bread with them. There are two young men in this family; and, should a young full-blood of their own age visit their camp, he will eat with the father, but the young half-breeds must wait until he is through."[5] Mr. Munroe states also that he took particular pains to discover whether the statement that "the Florida Seminoles were more than half of negro blood" were true or not, but failed to obtain any evidence in support of such an assertion. He further adds, "I have never seen a slave, nor yet a free negro, in any of the camps that I visited, and I have passed weeks at a time in company with these Indians."[6]

Mr. Munroe asked a young Seminole about the negroes, with the following result: "he looked at me steadily for a moment, without answering, and then holding up one finger, then a second, a third, and a fourth, he said, 'iste-hatke' ('white-man'), 'iste-chatte' ('red-man'), 'epah'

[1] "Notes of Florida" (see Report of Smithsonian Institution, 1885, Part ii. p. 215).

[2] WILLIAM KENNEDY, Texas, The Rise, Progress, and Prospects of the Republic of Texas (London, 1841), vol. i. p. 350.

[3] An Account of an Expedition from Pittsburgh to the Rocky Mountains, etc., compiled by Ed. James (1823), vol. ii. p. 267.

[4] MARCY and MCCLELLAN, Exploration of the Red River of Louisiana (1853), p. 101.

[5] "The Seminole Indians of Florida" (Fifth Annual Report of the Bureau of Ethnology, 1883–84, Washington, 1887, pp. 459–531).

[6] Loc. cit., p. 478.

[1] "The Seminole Indians of Florida" (Fifth Annual Report of the Bureau of Ethnology, 1883–84, Washington, 1887, p. 526).

[2] Loc. cit., p. 490.

[3] Loc. cit., p. 487.

[4] KIRK MUNROE, "A Forgotten Remnant" (Scribner's Magazine, vol. vii. 1890, pp. 303–317).

[5] Loc. cit., p. 306

[6] Loc. cit., p. 307

('dog'), with a decided emphasis, and 'iste-lustee' ('black-man'). There was certainly no need to question him further upon the subject."[1]

Amongst several of the Indian tribes now resident in the Indian Territory, negro slavery existed; but many adoptions have taken place, although the question does not even now appear to be quite settled. Mr. George A. Reynolds states,[2] "When the war ended, they [Seminoles] were destitute, and scattered from the Red River to Kansas. Again they sought the protection of the government. They formed new treaties; they complied with all the conditions imposed upon them; they adopted their former slaves, and made them citizens of their country, with equal rights in the soil and annuities. Their negroes hold office and sit in their councils." Mr. L. N. Robinson,[3] writing in August, 1869, calls attention to the failure of the Choctaw and Chickasaw nations to provide for the adoption (within the time specified) of "persons of African descent residing amongst them," as required by a section of the treaty of 1866, and points out that certain "difficulties in the Creek nation are to some extent attributable to the presence of the black element, and the agitation of questions growing out of their presence and participation in tribal affairs." He further remarks, "Under the Cherokee treaty, the separation of families, parent and child, husband and wife, is as complete, as cruel, and inhuman, as was ever the case worked under the system of slavery. The situation of the blacks within the Indian tribes taken as a class is a reproach to our boasted civilization and love of justice, which is inexcusable so long as the plan of colonization remains untried."

From the report for 1869,[4] we learn that "one peculiar difference exists between negro and Indian in the Five Nations [i.e., Cherokee, etc.]; i.e., intermarriage with Indian gives a United States citizen, male or female, rights, but intermarriage with negro does not." Some interesting information is contained in the report of Mr. Robert Owen to the commissioner of Indian affairs in 1888,[5] regarding the aborigines resident in the Indian territory. He says, "There are many negroes, former slaves to Indians; and among the Creeks is some negro miscegenation, though much exaggerated in reports on that subject. There are numbers of adopted citizens, — whites, other Indians, and negroes." In the Cherokee nation it appears that the 2,400 negroes, along with the other adopted citizens, have been denied the right to participation in public annuities. Among the Choctaws, negroes have been adopted and "given a *pro rata* of schools, right of suffrage, and citizenship, as provided by treaty." Similar is the condition of the negroes of the Creek nation. Of the blacks among the Chickasaws, Mr. Owen says, "They are still in the forlorn status, as stated in my last report. The Chickasaws are firmly resolved never to receive them. It is the palpable duty of the government to remove them."

In the Bermudas some miscegenation has taken place. About 1616 we find it recorded that a vessel arrived there which "brought with her also one Indian and a negro (the first these islands ever had)."[6] After the utter defeat of the Indians in the Pequot war, numbers of them were transported to the Bermudas from Massachusetts, and amalgamation of these with the negroes has to a certain extent occurred. Professor H. C. Bolton, in an interesting article on the Bermudian negroes, in the *Journal of American Folk-Lore*,[1] makes the following statement: "The colored population of Bermuda have, in general, attained a higher stage of development, and made greater progress in civilization, than their kindred in the southern United States. This is probably due in part to close contact (not amalgamation) with their Anglo-Saxon masters on these isolated islands, and in part to the admixture of Indian blood in their ancestors. Between the years 1630 and 1660 many negro and Indian slaves were brought into the British colony, — the negroes from Africa and the West Indies, and a large number of red-skins from Massachusetts, prisoners taken in the Pequot and King Philip's wars. Many of the colored people show in their physiognomy the influence of the Indian type. Moreover, slavery was abolished in 1834, Bermuda being the first colony to advocate immediate rather than gradual emancipation; but the importation of negroes from Africa had ceased long before, so the type resulting from the mixed races continued to dominate. The faces of many of the dark-skinned natives are really fine; their lips being thinner, noses sharper, cheek-bones less obtrusive, and their facial angle larger, than those of most negroes in the Southern States."

In Neill's "History of Minnesota,"[2] there is the following interesting passage, the facts to which it relates belonging to the year 1819: "Three miles above the mouth of the St. Louis River they came to an Ojebwa village of 14 lodges. Among the residents were the children of an African by the name of Bungo, the servant of a British officer who once commanded at Mackinaw. Their hair was curled and skin glossy, and their features altogether African."

A subject to which some attention has recently been devoted is the relation of the folk-lore of the negro to that of the Indian. This has been discussed at considerable length by Professor T. F. Crane, in his excellent review of "Uncle Remus,"[3] and we need but to cite his conclusion: "We are now prepared to consider briefly these stories, which are substantially the same in Brazil and in the Southern States. That the negroes of the United States obtained these stories from the South American Indians is an hypothesis no one would think of maintaining; but that the Indians heard these stories from the African slaves in Brazil, and that the latter, as well as those who were formerly slaves in the United States, brought these stories with them from Africa, is, we think, beyond a doubt, the explanation of the resemblances we have noted." Besides "Uncle Remus," Jones's,[4] and Gordon's and Page's,[5] contributions to negro literature may be studied to advantage. It is possible that a few of the negro stories were borrowed by the blacks from the red men. Such was the opinion of Major Powell.[6] Mr. James Mooney says of certain myths of the Cherokees,[7] "They resemble the 'Uncle Remus' stories, which I yet hope to prove are of Indian origin."

In the present paper no attempt has been made to exhaust the subject. South America and the West Indies have been left untouched. To make the study of the contact of the

[1] KIRK MUNROE, "A Forgotten Remnant" (Scribner's Magazine, vol. vii. 1890, p. 307).

[2] Report of Commissioner of Indian Affairs, 1869 (Washington, 1870), p. 417.

[3] *Ibid.*, p. 399.

[4] See p. 132; also Smithsonian Report, 1886, part ii. part v. p. 225.

[5] Fifty-seventh Report of the Commissioner of Indian Affairs, 1888, p. 131.

[6] Sir J. H. LEFROY, The History of the Bermudas or Summer Islands (ed. for Hakluyt Society, 1882), p. 84.

[1] Vol. iii. p. 222.

[2] E. D. NEILL, History of Minnesota (Philadelphia, 1858), p. 322.

[3] "Plantation Folk-Lore" (Popular Science Monthly, vol. xviii. 1881, pp. 824-833); see also C. F. HARTT, Amazonian Tortoise Myths (1875); HERBERT SMITH, Brazil, The Amazons, and The Coast; and the other literature cited by Professor Crane.

[4] Negro Myths of the Georgia Coast, 1888.

[5] Befo' de War. Echoes in Negro Dialect, 1888.

[6] J. C. HARRIS, Uncle Remus, Preface, p. 4.

[7] Journal of American Folk-Lore, vol. i. p. 106.

African and the American as complete as possible, it is highly desirable that attention should be paid to the obtaining of information regarding (1) the results of the intermarriage of Indian and negro, the physiology of the offspring of such unions; (2) the social status of the negro among the various Indian tribes, the Indian as a slave-holder, the opinion the negro has of the Indian; (3) the influence of the Indian upon negro, and of the negro upon Indian, mythology and folk-lore.

While there seems little probability of data existing, to any great extent, regarding the linguistic relations of the Indian and the negro, it is reasonable to expect that much relating to their physical anthropology, their social conditions, and their folk-lore, may yet be made known.

HEALTH MATTERS.

Bone Grafting.

MR. A. G. Miller, in the *Lancet* for Sept. 20, reports the history of a case in which he used decalcified-bone chips successfully to fill up a large cavity in the head of the tibia. In the *New York Medical Journal* it is stated that a piece of the rib of an ox was used, being first scraped and then decalcified in a weak solution of hydrochloric acid. After cleansing by pressure, it was placed for forty-eight hours in a carbolic-acid solution, one to twenty, then removed, and cut into small pieces. During the scraping-out of the cavity in the knee, preparatory to the grafting, a number of small pieces of bone were removed. These were placed in a solution of boric acid for use later in the operation. The cavity was then stuffed with the decalcified-bone shavings, the pieces of fresh bone being added last. The cavity thus filled was about two inches in diameter. Granulation and healing took place rapidly: the only pieces of bone that became necrosed were from the patient's own body. Mr. Miller is convinced, from his observation of this case, that the healing of large bone cavities, the result of injury or disease, is greatly facilitated by stuffing them with decalcified-bone chips; that these are superior to fresh bone; and that fresh bone not only is of no use, but actually hinders the process of granulation.

Recent Saving of Life in Michigan.

In a carefully prepared paper read before the Sanitary Convention at Vicksburg, the proceedings of which are published, Dr. Baker gave official statistics and evidence, which he summarized as follows: —

"The record of the great saving of human life and health in Michigan in recent years is one to which, it seems to me, the State and local boards of health in Michigan can justly 'point with pride.' It is a record of the saving of over one hundred lives per year from small-pox, four hundred lives per year saved from death by scarlet-fever, and nearly six hundred lives per year saved from death by diphtheria,— an aggregate of eleven hundred lives per year, or three lives per day, saved from these three diseases. This is a record which we ask to have examined, and which we are willing to have compared with that of the man who 'made two blades of grass grow where only one grew before.'"

To relieve an Overworked Brain.

A Swiss doctor says that many persons who extend their mental work well into the night, who during the evening follow attentively the programme of a theatre or concert, or who engage evenings in the proceedings of societies or clubs, are awaked in the morning or in the night with headache (*The Sanitary Inspector*). He is particular to say that he does not refer to that headache which our Teutonic brethren designate *Katzenjammen*, that follows certain convivial indulgences. This headache affects many persons who are quite well otherwise, and is due in part to the previous excessive work of the brain, whereby an abnormal flow of blood to that organ is caused, in part to other causes, for example, too great heat of rooms, contamination of the air with carbonic acid, exhalations from human bodies, and tobacco-smoke.

For a long while the doctor was himself a sufferer from headache of this kind, but of late years has wholly protected himself from it by simple means. When he is obliged to continue his brain work into the evening, or to be out late nights in rooms not well ventilated, instead of going directly to bed, he takes a brisk walk for half an hour or an hour. While taking this tramp he stops now and then and practises lung gymnastics by breathing in and out deeply a few times. When he then goes to bed, he sleeps soundly. Notwithstanding the shortening of the hours of sleep, he awakes with no trace of headache. There exists a clear and well-known physiological reason why this treatment should be effective.

NOTES AND NEWS.

THE Lecture Association of the University of Pennsylvania announces a special course of illustrated public lectures by Mr. Barr Ferree of New York, on Feb. 12, 17, and 19, on "The Influence of Christianity on the Development of Architecture." These lectures, which will be three in number, will treat of (1) the basilica, the formative period of Christian architecture; (2) the cathedral, the perfected form of Christian architecture; and (3) the monastic orders, the greatest Christian builders.

— The Snow-Shoe Section of the Appalachian Mountain Club, Boston, has arranged a winter excursion to Waterville, N.H., to which members of the club and their friends are invited. The main party will leave Boston, Monday, Feb. 16, by the nine o'clock train from the Lowell Station. Others will leave Boston Thursday evening, spend the night at Plymouth, and join the party at Waterville Friday morning. The return will be on Monday or Tuesday, Feb. 23 or 24. The expense will not exceed $15. Comfortable rooms with stoves will be provided.

— It is announced in the January "Proceedings of the Royal Geographical Society" that a competent observer, Mr. J. T. Bent, the explorer of Phœnician remains in the Bahrein Islands, has decided on undertaking an expedition to the mysterious ruins of Zimbabye or Zimbaoe, in Mashonaland, and other remains in the interior of South Africa, with the object of thoroughly examining the structures and the country in their neighborhood. The expedition has the active co-operation of the British East Africa Company and the Royal Geographical Society, and will be well equipped for geographical as well as archæological survey. It was to leave England at the end of last month.

— Mr. Robert Athelston Marr has resigned his position as assistant in the United States Coast and Geodetic Survey, to accept the professorship of civil engineering in the Virginia Military Institute. Mr. Marr was born in Tennessee in 1856, was graduated at the Virginia Military Institute, entered the Coast and Geodetic Survey in 1878, and since then has served with distinction in the triangulation and astronomical parties both on this coast and in California and Alaska. The coast survey service has lost an energetic and capable officer, and, while his colleagues will miss him, they wish him every success in his new duties. The vacancy caused by Mr. Marr's resignation has been filled by the promotion of Sub-Assistant Isaac Winston to the grade of assistant. Mr. Winston has for several years past had charge of one of the geodetic levelling parties of the survey.

— Among recent appointments of Johns Hopkins men, we note that of Felix Lengfeld (fellow 1887–88, Ph.D. 1888) as professor of chemistry and assaying in the South Dakota School of Mines; C. W. Emil Miller (A.B. 1882, fellow 1883–85, Ph.D. 1886) as professor of languages, Walther College, St. Louis, Mo.; Augustus T. Murray (fellow 1887–88, Ph.D. 1890) as Professor of Greek, Colorado College; Charles L. Smith (fellow 1887–88, Ph.D. 1889, instructor 1889–91) as professor of history, William Jewell College, Missouri; Edward L. Stevenson (graduate student 1887–88) as instructor in history, Rutgers College; Amos G. Warner (fellow 1886–87, Ph.D. 1888) as general superintendent of charities in the District of Columbia, as provided by the recent congressional appropriation for the district; and William K. Williams (Ph.D.

1889) as superintendent of classification and distribution in the Newberry Library, Chicago. Albert Shaw (Ph.D. 1884) has become the American editor of the *Review of Reviews*.

— M. Em. Deschamps transmitted from Mahé, on the Malabar coast, some interesting information respecting the Veddas, descendants of the first-known inhabitants of Ceylon. He says, according to the "Proceedings of the Royal Geographical Society," that they are probably the "Yakkas," or "demons," of whom the ancient works and legends speak,—an appellation derived from their demoniacal cult, and which was probably changed by the first conquerors of the island into that of "Veddas" ("hunters"). They inhabit a belt of forests lying on the eastern confines of the central province. As a race, they are rapidly disappearing, and now number only two hundred or three hundred. Their villages lie several miles apart, and consist of one or two huts, formed of the branches and bark of trees. Some, when the rains come on, find shelter in the rocks, and have received the name of "Galla-Veddas." Their weapons, consisting of bow, arrows, and hatchet, are their principal goods. They are great hunters. The Veddas never speak unless absolutely obliged, and do not know how to laugh. Their manner of speech is brusque, and their language is very poor, being deficient in whole series of words, i.e., trees, plants, colors, etc. Although living in the midst of a population which is at once polygamus and polyandrous, they remain monogamists. The baptism of children is the only ceremony to which they attach great importance. They have no chief or social organization. Their religion consists in fear of the demons, of which the jungle is supposed to be full. The dead are now buried in the forest. Not long ago it was the practice to simply abandon the corpses. The Vedda never betrays any sentiments: anger astonishes, and laughter exasperates him. Dancing is his favorite occupation. Doctors and medicines are unknown. The people meet to dance away the devil of a sick man. The men are rather small, strongly built; their lower limbs badly made, and not well proportioned; hair black and coarse; eyes black and sparkling, with a fierce look; forehead straight and broad; nose broad; the general appearance of the countenance not disagreeable; their body is maroon in color, and is repulsively dirty. The women are small, and possess few of the attractions of their sex. Their clothing, like that of the men, is of the scantiest.

— At a meeting of the Geographical Society of Paris held on Nov. 7, 1890, M. Cholet, the administrator of Brazzaville, gave some account of his recent ascent of the Sangha, an important and hitherto practically unexplored tributary of the Kongo. The Sangha enters the Kongo at Bonga, a French station between the embouchures of the Alima and Mobangi. The "Proceedings of the Royal Geographical Society" (Jan.) states that the traveller, who was accompanied by M. Pottier, quitted Brazzaville in the little steamer "Ballay" on the 19th of February, and on the 30th of March commenced their voyage up the Sangha. The river varies in breadth from 1,000 yards to a mile and a half. Its course is encumbered with islands and sand-banks, the latter, when the waters are low, swarming with hippopotamuses. In the lower course the river-banks are low and marshy. The villages lie far from the stream, and are inhabited by the Afurus, a commercial people, who bring ivory from the Upper Sangha down to Bonga. The middle course is inhabited by the Busindes, whose villages are situated on the banks, which are more elevated here. The upper part of the river, up to the point reached by the party, is inhabited by the Bassangas, a rich and powerful tribe, whose villages are built on islands. At the village of Uoso the Sangha receives an important affluent, the N'goko, and itself takes the name of Masa. The latter arm is over 2,000 yards broad, but the sand-banks prevented an ascent being made for any considerable distance. The N'goko has, on the other hand, a narrow bed, never exceeding in breadth 220 yards. High wooded mountains lie on both sides of the stream. Elephants abound in this region. The people live at a distance from the river. A few miles above Uoso the N'goko receives a tributary, the Mangango (100 yards broad), and changes its name to Monba. Beyond this point the country seems quite uninhabited. Navigation becoming difficult and provisions failing, the return voyage was commenced on the 15th of May, and Bonga was reached on the 31st of May. The natives were friendly after their first fears had been overcome. They have no relations with the people of the Mobangi, and are not cannibals. Judging by their weapons, language, and dances, they seem to resemble the Pahuins and the Udumbos. The country is rich in ivory. India-rubber was also found.

— It is with much pleasure that *Science* reprints the following extract from the *Congressional Record* of Feb. 6, 1891, on the consideration of the Sundry Civil Appropriation Bill in Committee of the Whole House, Feb. 5, 1891: "Mr. Cannon. Mr. Chairman,— I desire, if I can have the attention of the gentleman from Texas [Mr. Sayers], to state that the next eleven pages of this bill cover items of appropriation for the Coast Survey. They are about the same as in the current year, with the exception of an increase of about $13,000 for printing charts, etc., found to be absolutely necessary. Last year and this year the Committee on Appropriations gave a most exhaustive examination of this service, and I believe the committee is unanimously of the opinion that it is conducted in as economical, praiseworthy, and profitable a manner for the benefit of the government as any part of the public service; and that substantially, if not literally, we have given the amount that is estimated for. For the purpose of saving time, I ask the committee, with the approval of the gentleman from Texas, that we may pass over the Coast-Survey items." Such a speech is seldom made concerning a bureau of one of our departments, on the floor of our legislative halls; and it must be very gratifying to the superintendent, and to his subordinates, who several years ago felt that they were subjected to much criticism which was unjust. Recognition of this character serves to stimulate the zeal of those engaged in scientific pursuits as well as in other walks of life.

— The *El Diario*, July 3, of Buenos Ayres announces the return of M. Storm's expedition from the Pilcomayo, after an absence of over five months. Like other expeditions into this region, as quoted in the January "Proceedings of the Royal Geographical Society," the party encountered great difficulties, but escaped without loss of life. The river was navigated in the steamer for a long distance, and numerous obstacles were surmounted, but at last the leaders, with a few men, had to take to their canoes. Notwithstanding the hostility of the Indians, the party pushed on to the Bolivian frontier, and explored a large part of this little-known region. They have brought back important zoölogical and botanical collections. There seems to be no doubt that the western arm of the river is the true Pilcomayo.

— Further news of Capt. Page's unfortunate expedition up the Pilcomayo has been received by the Royal Geographical Society, London, in a letter from Mr. J. Graham Kerr, one of the English members of the party, who wrote from latitude 24° 58′, longitude 58° 40′, on the 4th of October last. He says that the expedition started with provisions for six months, and that they had then been nine months on the way, and were in a starving condition. Fortunately, however, they had been able to kill a good many deer. The relief party of twenty soldiers, sent up by the government, arrived on Oct. 4. The river Pilcomayo, he says, at that season is a mere brook, a few feet wide and only a few inches deep. Even in the season of higher water, when they ascended it, navigation was very difficult, owing to the shallowness and the numerous snags and tree-trunks that encumbered the passage. In April they resorted to the laborious method of constructing dams below the steamer, and waiting till the water rose to a sufficient height to move ahead for a short distance. They reached the position from which Mr. Kerr wrote, on June 14. Capt. Page died on his way down to obtain succor with three men in the only remaining boat. The remainder of the party, left to their own resources, were in daily fear of an attack from the hostile Indians of the Chaco; but, though watched continually, they received only one visit from them, on Sept. 18, and that passed off in a friendly manner. At the time of writing, preparations were being made for retreat down the river in the boat which brought up the relief party. If the boat should prove useless, they intended to burn it and march to the Paraguay, a journey of two months or thereabouts.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

BROWN ROT IN GRAPES.

IN a bulletin soon to be issued by the Ohio Experiment Station, Dr. C. M. Weed gives the following account of the downy mildew, or brown rot, of grapes :—

For many years the vineyardists of the great fruit belt in northern Ohio along the southern shore of Lake Erie have been troubled by a disease affecting the foliage and fruit of the grape, called "downy mildew," or "brown rot." At times this disease has ruined nearly the entire crop, and has threatened to destroy the vineyard industry over a large area. Fortunately, however, this disaster has been averted by the discovery of a method by which the disease can be largely or entirely prevented at comparatively slight expense.

The downy mildew, or brown rot, of grapes is a fungous disease; that is, it is a diseased condition of the foliage or fruit, due to the presence of a fungus. This fungus is a minute parasitic plant that develops at the expense of the tissues of the grape, thus causing blighting of the leaf, and decay of the fruit. It is distributed over nearly the entire eastern half of the United States, and occurs upon both the wild and cultivated varieties of grapes. It probably lived upon the former before the introduction of the latter. It attacks all the green parts of the vine, including the young shoots, as well as the leaves and berries, and, like other fungi, reproduces by means of spores,— minute bodies corresponding in function to the seeds of flowering plants.

When one of these spores falls upon a leaf where there is sufficient moisture, it germinates by sending out a little tube,— something as a kernel of corn in moist soil sends out its germinating radicle,— and this tube penetrates the epidermis, or skin, of the leaf. Once inside, the tube continues to grow, pushing about between the cells of the leaf, and forming what is called the mycelium or vegetative portion of the fungus, which may be likened to the roots of higher plants. As there is little nourishment to be obtained between the cells, this mycelium develops minute processes, which push through the cell walls and absorb the contents.

After this mycelium has developed in the leaf for some time, it is ready to produce its spores. Consequently it sends out through the breathing-pores, or stomata, of the leaf, its fruiting branches. These bear upon their tips small oval bodies, which are the spores. The "mildew," which is visible to the naked eye, is composed of these fruiting branches and their spores. It only develops under certain atmospheric conditions, so that the mycelium may exist in the affected parts of the vine for some time before this outward manifestation of its presence occurs. This is the reason that a vineyard may apparently be "struck" with mildew in a single night.

Besides the spores above described, which are produced during the summer season, and consequently are called summer spores, there is developed in the fall a different class of spores by which the fungus passes through the winter. Hence these latter are called the winter spores.

A knowledge of the method of development of the fungus makes it evident that it cannot be reached after it has penetrated its host. Consequently remedial treatment must be limited to destroying the spores, and preventing their ingress to the tissues of the plant. The experience of the last few years has shown that this can be successfully accomplished by spraying the vines with dilute solutions of certain salts of copper, particularly sulphate of copper, or blue vitriol.

Experiments with these copper compounds as preventives of the several fungous diseases of the grape have been in progress in France for a number of years, and have been attended with remarkably successful results. The subject was taken up in America about the middle of the last decade, and wonderful progress has since been made. The Ohio station feels largely indebted to the United States Department of Agriculture for the results obtained, especially to Messrs. Scribner and Galloway, who have had the work in charge. In Ohio the first experiments were apparently made by Mr. George M. High, of Ottawa County, who for the last five years has tested the remedies thoroughly, and has triumphed over the unprogressive growers who were content to let the disease destroy their crops rather than try any new-fangled methods of checking it.

THE NAME "AMERICA."

AT the eighth international congress of Americanists, which was held in Paris from Oct. 14 to Oct. 20, 1890, only a certain number of the questions treated were of interest from a geographical point of view. Among these may be mentioned the discussion on the origin of the name "America," which was opened by M. Jules Marcou, who asserted, as we learn from the "Proceedings of the Royal Geographical Society," London, that the name "America" was derived from a range of mountains in Central America, which, in the language of the natives, is called "Amerique;" and that Vespucci never bore the Christian name of "Amerigo," because this latter is not a saint's name in the Italian calendar; and, further, that he changed his name "Alberico" to "Amerigo" for the first time after the name by which the New World is now commonly known began to be used, in order to cause it to be believed that the continent was so named in his honor. But M. Govi proved two years ago that the name "Alberico" is in the Florentine language identical with "Amerigo;" and that Vespucci, before the year 1500, sometimes subscribed himself "Amerigo" appears from a letter recently discovered among the archives of the Duke of Gonzaga at Mantua. This point was corroborated by the Spanish-Americanist, De la Espada, from letters and pamphlets preserved in the Archiv de las Indias at Seville, in which Vespucci sometimes calls himself "Alberico," and sometimes "Amerigo." *En passant*, the Spanish *savant* mentioned the interesting fact that the first of the so-called "quatuor navigationes" was not made by Vespucci at all.

M. Hamy adduced a further interesting proof of the incorrectness of M. Marcou's contention, in the shape of a map of the world prepared in the year 1490 by the cartographer Vallescu of Mallorca, on the back of which is a note to the effect that the map was bought in at an auction by the merchant Amerigo Vespucci for 120 gold ducats. Further, the general secretary of the congress, M. Pector, pointed out, that, according to a communication received from the president of Nicaragua, the range of mountains in question is not called "Amerique" at all, but "Amerisque." After this very thorough discussion of the question, it is to be hoped that the accusations against Vespucci and Hylacomylus may not be heard of again. An important contribution to the cartography of America was furnished by the paper read by M. Marcel upon two globes discovered by him, which date back probably from the year 1513.

SCIENTIFIC RESULTS OF NANSEN'S JOURNEY ACROSS GREENLAND.

DR. FRIDTJOF NANSEN, at a meeting of the Geographical Society of Berlin, Nov. 8, 1890, read a paper on his journey across Greenland, with special reference to the scientific results of the same. By this expedition it is shown ("Proceedings of the Royal Geographical Society," London) that the whole of Greenland south of about 75° north latitude is covered by an immense unbroken coating of inland ice. How far this covering extends over northern Greenland is not yet accurately known. That it must go beyond 75° is evident from the mighty glaciers which project into the sea along the whole of the west coast of Greenland. Of these, the immense glacier at Upernivik shows a movement of as much as 99 feet in 24 hours. Such glaciers must of necessity be fed by an unbroken ice-covering in the interior, because otherwise they would not have sufficient material for their enormous production. Although under 80° north latitude there are large glaciers, like the Humboldt glacier, still the latter appears to have no important motion; and, inasmuch as Grinnell Land also is not completely covered with ice, it is quite possible that the extreme north of Greenland, in consequence of the atmospheric precipitation being too insignificant, is no longer wholly overlaid with this ice-covering.

The highest point reached by the expedition exceeded 8,915 feet, and lies about 112 miles from the east coast and 168 miles from the west coast. But the highest part of the ice does not lie so near to the east coast as might appear from the foregoing: for, in the first place, the route of the expedition was not at right angles to the coast, but inclined to the longitudinal axis of the country, the direction being first north-west and then west-south-west; and, secondly, the land in the interior rises from the south to the north. Consequently the highest point of the ice lies, in fact, nearer the middle of the country than would appear from the route. The periphery of the ice-covering corresponds pretty much to the segment of a circle of about 6,450 miles diameter. The Jensen journey into the interior gives a circular periphery with a radius of 5,560 miles; and Nordenskiöld's journey, one with a radius of 14,530 miles. It follows that the upper side of the inland ice forms a remarkably regular cylindrical surface from one coast to the other, although the radii of this cylinder increase considerably from south to north. The underlying land is certainly, as the numerous fiords prove, just as mountainous as Norway. But the fact that the surface of the ice is so regular is due to the pressure of the plastic ice-masses, and the surface of the ice reaches its highest level just where the resistance to this force is greatest. The watershed of the underlying land lies nearer to the east coast than to the west; then the resistance to the pressure of the masses of ice will also be greater on this side than on the west coast, and the high ridges of the ice-covering will also be found to lie between the middle axis of Greenland and the water-divide of the land buried beneath the ice.

The thickness of the Greenland ice, Nansen estimates at from 5,000 to 6,000 feet over the valleys of the underlying land. The pressure of a glacier 6,000 feet high upon its base would amount to at least 160 atmospheres: the ice-masses must therefore exercise a strong moulding influence upon the land. The inland ice at a short distance from the coast is composed of fine dry snow, on the top of which the sun in summer only is powerful enough to form a thin melting crust. The ice-poles six feet long could be driven into these masses without striking firm ice.

The daily variation in the temperature amounted, in the month of September, to from 36° to 45° F. The annual variation must be enormous. The moisture of the air is very great: with few exceptions, it amounted to between 90 and 100 per cent. The number of days of atmospheric precipitation is also large. Of the forty days occupied by the expedition in crossing the ice, four were rainy, snow fell on eleven, and hail on one. Inasmuch as there is now no melting of the ice in the interior of Greenland, and evaporation also is almost *nil*, the chief factor in preventing the further increase of the ice-masses, apart from the great part which is played by the movement of the ice-masses in the direction of the coast, is apparently to be found in the "terrestrial heat." Given the mean annual temperature on the surface of the inland ice at −22 F., and the geo-thermic scale of depth of the ice at about 55¼ feet per 1° F., the temperature of the ice would, even at 3,000 feet, stand at melting-point. In any case, an active melting process goes on at the bottom of the ice, and rivers pour forth into the sea from under the ice in winter as well as in summer. Nansen himself had the opportunity of observing this during the most rigorous winter. These streams, which must flow under the enormous pressure of the ice-masses, are powerful eroding agents. The formation of the "asar" in Sweden, and of the "kames" in Scotland, England, and Ireland, are apparently to be accounted for in this way.

LETTERS TO THE EDITOR.

⁂ Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

What caused the Obliquity of the Ecliptic.

IT is difficult to bring the mind to believe that there ever was a time when there were no seasons,— spring, summer, autumn, and winter, — as now. In attempting to account for natural phenomena, we have nearly always assumed that the axis of the earth was orignally inclined to the plane of the ecliptic at an angle of 23½°, as we now find it, and of course we in consequence have formed in our minds the idea of the annual recurrence of the seasons through all geological time; but the elimination of the seasons from the early history of the earth has been forced upon us by the accumulation of facts from the geological record. There is abundant evidence to prove the existence of tropical or sub-tropical animals and plants in Arctic latitudes as late as the tertiary. In Professor Dana's "Manual of Geology" (third edition, p. 352) that author says, "If we draw any conclusion from the facts, it must be that the temperature of the Arctic zone differed little from that of Europe and America. Through the whole hemisphere, and we may say world, there was a genial atmosphere for one uniform type of vegetables, and there were genial waters for corals and brachiopods." Scarcely any one now, who is conversant with the facts, will deny that the early history of the earth was marked with a uniform, or nearly uniform, temperature, in all latitudes, prior to and including most of the tertiary. The main difference of opinion existing now among scientific men is how to account for such uniform, world climate.

So of the glacial period. Every one admits that the great array of facts justifies the conclusion that the poles of the earth were, since the tertiary, covered with great ice caps or sheets several thousand feet thick, and reaching down to the 40th parallel of latitude, constituting the great glacial epoch. There is a wide divergence of opinion, however, as to the origin or cause of this glacial cold. Mr. Croll, in his "Climate and Time," has formulated a theory, derived from the secular changes in the eccentricity of the earth's orbit, through which he finds a place for the glacial period; but this theory, if true, must provide for alternation of warm and cold periods at the poles throughout all geological time. Professor James Geikie of Scotland, in his "Great Ice Age," indorses this theory, and attempts to find evidences of former glacial action, not only in the tertiary, but also in mesozoic and paleozoic times. But the weight of the evidence seems to be against this theory, and Mr. Geikie himself admits that much of his "evidence" is "not very convincing."

The best and most satisfactory explanation of the warm and cold periods at the poles has been made by Professor C. B. Warring, in a paper read by him before the New York Academy of Science, and published in the *Popular Science Monthly* for July, 1886. This paper merits a much more extended notice than it has apparently received, for its author has very strongly fortified his several propositions. Briefly, his argument is this: The existence of tropical vegetables in Arctic latitudes cannot be supported upon the theory of a warm temperature only. Light was as necessary as heat; and this light must also have been uniform

and unbroken by long periods of darkness, for, if there had been a long night of four months in every year, as now, it would have been fatal to all plants, and even many or most of the animals. Therefore, down to nearly the close of the tertiary, the axis of the earth was perpendicular to the ecliptic, and the days and nights were everywhere and always equal. The temperature was kept up by means of the carbonic acid and aqueous vapor in the atmosphere, which formed a sort of "double blanket," and served to retain the heat radiated from the sun. After a long period the carbonic acid was most of it taken up from the atmosphere to form our coal-beds, peat, petroleum, graphite, etc. This process was followed by a thinning of the retaining cover. The heat from the sun was not all retained, but was lost again by escaping into stellar space. "Holes in the blanket" appeared at the poles, ice and snow began to accumulate there, and eventually the glacial epoch was inaugurated. Furthermore, he shows, that, ac-according to the nebular hypothesis, the axes of the earth and moon ought to have been, in their normal condition, parallel with each other, and both perpendicular to the plane of the ecliptic; but instead, the earth's axis is inclined 23½°, while the moon's axis is practically perpendicular, it being inclined only 1° 30'. The change, therefore, was with that of the earth, and was effected since the moon's separation from the earth. "In view of all these facts," he says, "it seems most probable that in that blank interval the glacial epoch, or more largely between the end of the miocene and the beginning of the Champlain, that movement occurred which gave the earth seasons, unequal days and nights, and greatly enlarged its limits of inhabitability. . . . When the axis became oblique, more solar heat fell within the polar circle, those regions became warmer, and the glacial epoch departed. If these conditions — a perpendicular axis and high uplifts — could be to-day restored, the atmosphere remaining as it is, the glacial epoch would return."

It is the purpose of the present article to emphasize the reasons for believing the direction of the earth's axis was changed about the time stated above, and also to suggest the probable cause of the change. In order to do this more intelligently, we must take a more comprehensive view of the glacial epoch and all its attendant phenomena than is usually found in any one or many of the text-books, or papers, reports, and lectures, upon the subject. Of all the geological changes and revolutions in the earth, out of which has been evolved the present world of animal and plant life, the glacial epoch is certainly the most unique, and full of interest to the scientific observer. What caused the glacial cold has been the constant inquiry, but never answered, ever since it was first proposed some forty or fifty years ago. Why should corals live in security in Spitzbergen, and the red-woods of California and the cypress-trees of the southern United States flourish in the north of Greenland as late as tertiary times, where now are the almost constant rigors of an Arctic winter? What caused the recession of the glaciers, and why may we not have a recurrence of them? What influence, if any, did the polar ice-caps exert upon tho ocean-level and ocean-currents? Were the ice-caps equal in magnitude; and, if not, what effects, if any, followed such inequality, from the attraction of the sun and moon upon the mass of the earth, thus abnormally distributed? These questions and kindred ones must be considered before we are prepared to comprehend the full significance and consequences of the glacial epoch.

It seems incredible that a great ice-cap, several thousand feet thick, should accumulate, and remain throughout the summer, in the temperate zones, if the ecliptic were as oblique in those times as now. The sun on the 21st of June would be nearly perpendicular to the southern limit of the glacier, and would certainly exert a powerful influence in preventing its formation or accumulation south of the northern limits of Minnesota. On the other hand, however, if we place the sun continuously perpendicular at the equator, the temperate zone would be characterized by continual spring weather similar to that occurring in April at the present time. In such case we may readily conclude that the precipitations of snow might be greater than that melted by the slanting rays of the vernal sun, and hence might continue to increase, and form a glacier of ice.

It appears that the polar ice caps in glacial times extended as far as the 40th parallel of latitude from either pole; in some places the north glacier in the United States extended as far south as the 39th, and even to the 38th parallel; and in South America Professor Agassiz found evidences of glacial action as far north as the 37th parallel. Mr. D. Forbes informed Mr. Darwin that he had seen ice-worn rocks and scratched stones at about 12,000 feet height, between 13° and 30° south latitude. There seems also some evidence of glacial action in the south-east corner of Australia. In northern Asia, owing to the great extent of land surface, it may be reasonably inferred that the southern limit of the glacier was much beyond that in the United States. The mountain-ranges in both hemispheres doubtless were covered with a much greater accumulation of snow and ice than they are at present, extending at that time to within the tropics, and perhaps to the equator. But from the whole record, we may safely assume 40° as the average limit of each, the southern being the more widely extended of the two. There are many evidences that these ice-sheets were not confined to the land, but that they crossed gulfs, seas, and even oceans. Professor H. Carvill Lewis, in a lecture published in the *Journal of the Franklin Institute* for April, 1888, says, "It probably also filled the bed of the Atlantic with ice far south of Greenland, the edge of the glacier reaching from New Foundland to southern Ireland in a concave line;" and Professor Geikie says the German Ocean was entirely filled with ice. Similar evidence has been found as to the antarctic glacier. We have therefore two magnificent circular polar ice-caps, each of them nearly 7,000 miles in diameter, and the two covering about 61,000,000 square miles of the earth's surface, leaving a zone of non-glaciated surface at the equator of about 139,000,000 square miles; so that, at the culmination of the glacial epoch, nearly one-third of the earth's surface was covered with ice.

If, now, we could ascertain the thickness of these great glaciers, we could easily estimate the amount of the earth's mass taken up in the form of aqueous vapor, transferred to the polar areas, and there deposited in the form of snow and ice. While admitting the incompleteness of the record, the weight of the evidence at present is to the effect that the antarctic glacier was much larger than the arctic. Upon general reasoning, this ought to have been true; for three-fourths of the land surface of the earth are in the northern hemisphere, and the amount of water surface in the southern and northern hemispheres respectively is in the ratio of 85 to 60. In the southern hemisphere, therefore, there ought to have been a greater amount of evaporation; and, in the absence of any known air-currents to carry this evaporation to the north of the equator, there would necessarily be a greater amount of precipitation in the southern hemisphere, and consequently a greater accumulation of ice. That such was the fact in glacial times, seems to be indicated by what is conceded to be an imperfect record. Professor Dana, in his "Manual of Geology," estimates the thickness of the northern glacier in America to have been 11,500 feet on the watershed of Canada. Professor Le Conte, in his "Elements of Geology," says, "The archæan region of Canada seems to have been . . . covered with a general ice mantle 3,000 to 6,000 feet thick;" and Professor James Geikie says the Scandinavian ice-sheet "could hardly have been less than 6,000 or 7,000 feet thick." As Norway extends nearly to the 72d parallel of north latitude, it is not probable that the northern glacier exceeded two miles in thickness at its greatest height. Professor Le Conte says, "Greenland is apparently entirely covered with an immense sheet of ice, several thousand feet thick, which moves slowly seaward, and enters the ocean through immense fiords. Judging from the immense barrier of icebergs found by Capt. Wilkes on its coast, the antarctic continent is probably even more thickly covered with ice than Greenland." Sir James Clark Ross reports having sailed for several hundred miles along a perpendicular wall of ice 180 to 200 feet high in the antarctic continent, and found only one place where the top of the ice could be seen from the mast-head of his ship; and Capts. Cook and Wilkes both confirm the report of a large ice-sheet in that part of the world. Professor Croll, in "Climate and Time," estimates, from all the data at hand, that the thickness of the southern ice-cap at its greatest height is not

less than twelve miles. It is not probable that the antarctic glacier was much, if any, higher than this in glacial times; for it will be readily understood, that, after the glaciation had proceeded so far as to place the south pole in the midst of a vast ice plain, the incoming clouds from the surrounding oceans would deposit most of their moisture before reaching the centre, and the glacier would be built up at or near its circumference. Hence we should expect to find the glacier, instead of thinning gradually from twelve miles at the centre to nothing at its outward edges, would present more the appearance of a great section of a hollow sphere of nearly uniform thickness, laid over the earth at the pole.

Further confirmation of this view is found in the fact that the southern hemisphere has a cooler mean annual temperature than the northern. Mr. Croll says this is due to the constant transferrence of heat to the north by means of ocean currents, nearly all the great currents originating south of the equator; while Sir Charles Lyell thinks the true cause lies in the fact of the smaller extent of land surface in the south. It is also true that from March 20 to Sept. 22 — the duration of the sun's northern declination — there are 186 days, while from the autumnal to the vernal equinox there are only 179 days: the northern summer is therefore seven days longer than the southern summer, and the southern winter is that much longer than the northern. If this inequality in the length of the summer and winter in the two hemispheres had its origin during the glacial epoch, it would at least have the effect of melting the ice in the north more rapidly than in the southern hemisphere; and, if it existed before glacial times, the effect would have been to accelerate the growth of the southern ice-cap more rapidly than that of the northern.

At the culmination of the glacial epoch, therefore, we may assume that the northern glacier was of an average thickness of 1 mile, and in extent about 25,000,000 square miles, making 25,000,000 cubic miles of ice; that the area covered by the southern glacier was about 30,000,000 square miles, and 5 miles of average thickness, making 150,000,000 cubic miles of ice; and the two extending over more than one-fourth of the earth's surface, and aggregating 175,000,000 cubic miles of ice. These two gigantic "fossils" would be equal in size to about one-thirtieth part of the bulk of the moon, and would represent an amount of evaporation from the water surface of the earth sufficient to lower the sea-level more than 5,000 feet, or about one mile.

Now, I submit that the attraction of the sun and moon upon this mass of ice would, if continued for a long time, be sufficient to effect some change in the direction of the earth's axis. Just how much that change would be, I have not determined; but that there would be some change seems to be evident from the bare statement of the proposition. When we consider that this matter has been removed to the poles from the equatorial regions, the inequality of distribution of the earth's mass would be greatly augmented. The action and re-action of the sun and moon and the planets on the protuberant mass of matter about the equator produce what is called "nutation," and the procession of the equinoxes. Now, this mass being equally distributed around the earth like a ring at the equator, only the nutation, or nodding, of the axis is produced. But in the case of the antarctic ice-caps the result of the attraction would be somewhat different; for, this being largely at one side or at the pole, and the mean attraction of the moon being in the plane of the ecliptic, its tendency would be to draw the mass towards the ecliptic — so far, at least, until an equilibrium should be found.

That the relative magnitudes of the two polar ice-sheets should always remain the same, would hardly be presumed. The sinking of the ice to the bottom of the Northern Atlantic would necessarily cut off the Gulf Stream, and prevent its further progress northward, if it existed in preglacial times. Even if the ice extended only a few hundred feet below the surface, it would materially interfere with that current, since it is a broad shallow stream, flowing upon the top of the ocean. Similar conditions in the southern ocean might have aided the causes already named in effecting a change or changes in the relative sizes of the two great glaciers. During such changes, therefore, if any existed, oscillations of the earth's axis may have occurred before it became fixed as at present. We should therefore expect to find pauses in the recession, and perhaps a re-advance, of the northern glacier; and such we do actually find from an examination of the great Kettle Moraine in the northern United States, and of the reindeer epoch in Europe.

As already stated, the ocean-level would be very materially lowered. Thus we can account, in part at least, for the land elevations in high latitudes, to which all geologists resort for a partial explanation of glacial phenomena. True, this lowering of the level would be co-extensive with the entire ocean surface; and the old shore-lines would be found, if discovered at all, below the present water-level. But, as Professor Dana says, "elevations of land do not leave accessible records like subsidences." One of the strongest evidences of land elevation is the existence of numerous extensive fiords, which Professor Dana says are "valleys of erosion," and which Professor Le Conte calls "half-submerged glacial valleys." But, as the ice did not exist at sea-level in low latitudes, these fiords are not found there as fossil remains to mark the degree of elevation. But we know that England was united to the continent of Europe by dry land, that the Mediterranean sea was an interlocked fresh-water lake, that the delta of the Mississippi was at least 400 feet higher than it is at present, and that many of the islands of the Pacific Ocean were at a higher level. Professor Winchell, in his "Pre-Adamites," says that probably the now sunken continent of Lemuria, in the Indian Ocean, was dry land during the glacial period, as were also some of the Malay Islands and others. Professor Le Conte says, "The boldness of the whole Pacific coast, especially in high latitudes, indicates a previous more elevated condition of the land surface [during the quaternary] than now exists;" and Mr. Darwin thinks that "at this period of extreme cold the climate under the equator at the level of the sea was about the same with that now felt there at the height of six or seven thousand feet."

Moreover, if this inequality in the amount of the accumulation at the two poles existed as intimated, it would be sufficient to remove the centre of gravity of the earth a little to the southward of its former position. This would be followed by a greater flow of water from the north polar regions; and here we would have another cause of land elevation in high northern latitudes, since lowering the water-level is equivalent to an elevation of the land. While there may have been local elevations and subsidences of the land surface in high latitudes during the glacial and Champlain periods, there seems to be strong reason for believing that the growth and decay of the two great ice-barriers added materially to such changes of level by alternately lowering and elevating the general ocean surface. This lowering of the sea-level might be taken into account in considering the question of the geographical distribution of plants and animals; but it is not my design to pursue that branch of the subject here.

The suggestion here made, that the large accumulation of the earth's mass at the south pole was one of the contributive causes of the change in the direction of the earth's axis, is but a corollary to Dr. Warring's statement, that "between the end of the miocene and the beginning of the Champlain, that movement occurred which gave the earth seasons, unequal days and nights, and greatly enlarged its limits of inhabitability."

T. A. BEREMAN.

Mount Pleasant, Io., Feb. 5.

BOOK-REVIEWS.

Hegel's Logic: a Critical Exposition. By WILLIAM T. HARRIS. Chicago, S. C. Griggs & Co. 16°. $1.50.

WHAT Hegel calls logic is what other folks call metaphysic; and Mr. Harris has here undertaken to tell us what, as he understands it, Hegel's metaphysic is. We say "as he understands it;" for it is notorious that Hegel's disciples have not been agreed as to what his philosophy really is, some giving it a pantheistic or atheistic interpretation, while others, like Mr. Harris, think it a perfect philosophical basis for Christianity. This disagreement is partly due to the obscurity of Hegel's style, which makes it impossible in some cases to understand him, and his disciples have in this respect followed the bad example of their master. The

following passage, for instance, in Mr. Harris's work, can hardly be called intelligible: "In the category of ground, or substrate, says Hegel, 'the simple identity of essence is in immediate unity with its absolute negativity.' That is to say: Reflection posits identity and non-identity by relating to itself; its return is a self-repulsion" (p. 333). If our readers can find a meaning in that, they will do better than we can.

As regards method and doctrine, the great blunder of Hegel, as of some other Germans, consists in mistaking mere abstractions of thought for concrete realities, and this blunder is the source of most of their peculiar doctrines. Moreover, the claim put forth by Hegel and his followers, that their philosophy is all deduced from pure thought, without any elements derived from experience, is not in accordance with the facts. The idea of thought itself is derived from experience, and so is that denoted by the word "pure." Then the ideas of being, quantity, quality, relation, and others, which are essential data in Hegel's system, are obviously got by experience; and thus the claim that his philosophy is independent of experience cannot be allowed. Happily, the Hegelian philosophy is already dead in the land of its birth, and is rapidly dying elsewhere; and the feeble attempts of certain Americans to galvanize it into life again are foredoomed to failure.

AMONG THE PUBLISHERS.

THE word "croup" carries such terror with it, and is applied to so many conditions in infancy, that Dr. W. L. Carr's exhaustive article on "Croup as a Symptom in Different Diseases," in the February number of *Babyhood*, will be read with interest by thousands of young mothers. A hardly less important topic is treated by Dr. William H. Flint in his article on "The Causes of Foul Breath in Childhood," which points out clearly the origin of that annoying condition, and will be found of practical value. "A Short Talk about Ears," by Dr. W. K. Butler, is another leading medical article. In a lighter vein are contributions on such subjects as "Spoiling a Child," "Baby's Memory," "Nursery Methods in Vienna," etc.

— "Across East African Glaciers" is the title Dr. Meyer has given to his account of the first ascent of Mount Kilima Njaro, one of the most important events of recent African exploration. It will be published immediately in this country by Longmans, Green, & Co.

— We have received from the Open Court Publishing Company of Chicago a pamphlet by Alfred Binet, "On Double Consciousness," consisting of articles reprinted from the *Open Court*. The introductory chapter is on the study of experimental psychology in France, in which the author points out that the school to which he himself belongs have devoted themselves in the main to pathological psychology, or the study of the mind in abnormal states. He then takes up the various phenomena observed of late years which appear to him to show that there may be in a given individual a double consciousness, or, as he sometimes expresses it, a double personality. In support of this view, he recounts a number of curious experiments; but the reasoning by which he deduces from them his theory of double personality seems to us very incautious and inconclusive. In particular, he constantly confounds personality with consciousness, — a mistake that could not be made by any person trained in philosophy. M. Binet's experiments will interest those engaged in similar researches, but his theories should be accepted with great caution.

— Mr. Charles F. Cox read a paper before the American Folk-Lore Society in November last on "Faith-Healing in the Sixteenth and Seventeenth Centuries," which has now been issued as a pamphlet from the De Vinne Press, New York. The object of the paper is to delineate some of the older forms of what is now known as "Christian science," which were far more extravagant

Publications received at Editor's Office, Feb. 2–7.

LANGLEY, E. M., and PHILLIPS, W. S. The Harpur Euclid. London, Rivingtons. 515 p. 12°. (New York, Longmans, Green, & Co. $1.50.)
ROADWAYS and Maintenance, and Road Laws. Essays by various authors. Philadelphia, Univ. of Penn. Pr. 319 p. 8°.
TALMAGE, J. E. Domestic Science. Salt Lake City, Juvenile Instructor Pr. 331 p. 12°.
U. S. MARINE-HOSPITAL SERVICE, Annual Report of the Supervising Surgeon-General of the, for the year 1890. Washington, Government. 387 p. 8°.
WHITING, H. A Short Course of Experiments in Physical Measurement. Part II. Cambridge, John Wilson & Son. 583 p. 8°.
WHITMAN, J. M. Constructive Steam Engineering: Embracing Engines, Pumps and Boilers, and their Accessories and Appendages. New York, Wiley. 900 p. 8°. $10.

than the form now prevalent. The author begins by remarking that "there is no absolutely new form that superstition can assume. It long ago passed its highest point of evolution, so that species of this genus do not now originate. Such varieties as occasionally seem to arise anew and flourish for a while are merely re-appearances of the ancient stock, greatly weakened in character and with a decidedly reversionary tendency." He then goes on to explain more particularly some of the magical remedies of earlier times, such as "sympathetic ointments," laying-on of hands, etc., quoting extensively from writers who believed in them as to their wonderful efficacy. The prevalence of the belief in magical cures is attributed largely to the influence of Paracelsus, who taught that "imagination is the cause of many diseases; faith is the cure for all." The passages quoted from Paracelsus and others can hardly be read without astonishment, mingled with something like disgust; and we may well rejoice with Dr. Cox that "the dark days of centuries past can never return, and that science has gained a supremacy which can never be lost."

— A very successful tableau entertainment was recently given in New York, the subjects being taken from illustrations in the current magazines. The idea is a simple one, and if the subjects are well chosen it can be made very interesting. The Century Company has prepared a list of suitable pictures with suggestions for any one who wishes to get up the entertainment. They will send it free on request.

— The course of four lectures on the electro-magnet, delivered before the Society of Arts, London, in February of 1890, by Silvanus P. Thompson, has been published in book form by the W. J. Johnston Company of this city. The volume is published with the direct sanction of the author, who has carefully revised the text; and it is the only authorized American edition. It will of necessity take its place as a standard work in the growing literature of electrical science, containing, as it does, in compact form, every thing of value on the subject, from the earliest experiments of Sturgeon in 1825, down to the present day. The volume contains a full theoretical and practical account of the properties and peculiarities of the electro-magnet, together with complete instructions for designing magnets for any specific purpose. It is illustrated with 75 engravings, and has a very full index.

— D. C. Heath & Co., Boston, induced by the success of the Wright's "Nature Readers" for supplementary reading, will soon add to the series a "Fourth Reader." This fourth book will take up the following subjects: Section I., earth-building; Section II., the solar system; Section III. will treat of the fauna of the world up to the age of man, various discoveries of their remains will be noted, and the interesting studies of fossils and geologic formations will be detailed; Section IV. will treat of those families of living creatures that have their closest affinities with the long-vanished fauna; Section V. will discuss certain of the reptilian family; Section VI. will introduce the mammals of sea and air. The object throughout the book will be not so much to cram the pupil with ideas as to teach how to study and how to observe.

— Volumes II. and III. of "Open Sesame," edited by Mrs. B. W. Bellamy and Mrs. M. W. Goodwin, have been published by Ginn & Co., completing a useful and valuable series, the first volume of which was mentioned in these columns nearly a year ago. Volume II. is intended for boys and girls between the ages of ten and fourteen, and aims, like Volume I., to at once stimulate and feed the memory, the collection of prose and poetry being well calculated to make children "learn to love, and love to learn" good literature. The same remarks will apply with equal force to Volume III., though the selections in it are intended for children of older growth. The series may be considered a standard collection of poetry and prose for purposes of recitation or reference.

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SCIENCE

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CALENDAR OF SOCIETIES.

Women's Anthropological Society of America, Washington.

Feb. 14. — Miss Kate Foote, Mission Indians.

American Institute of Electrical Engineers, New York.

Feb. 24. — Oscar T. Crosby, Data and Results of Experiments with Electric Traction at 120 Miles an Hour.

Boston Society of Natural History.

Feb. 18. — Warren Upham, Walden, Cochituate, and other Lakes enclosed by Modified Drift; W. H. Niles, Notes upon Asphaltum Deposits in California.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED—A position to teach Electrical Engineering by a student from leading English and French and U. S. science schools, or would accept position as Consulting Electrical Engineer, Electrician, etc. Very highest testimonials. London & Hartford Publishing Co., N. Y. (International Press Department.)

WANTED.—A young man in college would like a position during the summer of 1891 in some scientific work, particularly Orinthology, either as an instructor or tutor, or in making collections or accompanying some scientific expedition. Can give good references. Address HUBERT L. CLARK, Amherst, Mass.

WANTED.—A young man who has been teaching in a first-class High School desires a position in a similar institution. Is competent to teach Mathematics, Latin, Book-keeping, and the English branches. Can give highest references. Address H. W. MARTHENS, 6208 Broad St., Pittsburgh, Pa.

WANTED.—A situation in a scientific house by a graduate of the scientific department of the Jersey City High School as Geologist, Mineralogist or as assistant teacher in Physics or assistant to a chemist. Best of references. E. W. PERRY, 582 Third Street, Jersey City, N. J.

WANTED.—By a medical student of three courses, a position on some war or mercantile vessel sailing between America and some foreign country, as Clerk, Assistant Physician or Druggist, or any respectable occupation. Content with a moderate remuneration. Highest commendations. W. L. S., *Science* Office.

INFORMATION WANTED.—Clarence W. Bowen, Secretary of the Committee on the Centennial of Washington's Inauguration, 251 Broadway, New York, desires information regarding the portraits of John Hathorn and Jeremiah Van Rensselaer, members of Congress from New York. These portraits, for the Memorial Volume, are particularly desired, to complete the list of portraits of the New York delegation in Congress at the time of Washington's inauguration.

WANTED. — One first-class instrument-maker. Apply by letter to T. C. MENDENHALL, Superintendent U S. Coast and Geodetic Survey, Washington, D. C

WANTED.—An Entomologist to accompany a camping party of boys during July next. Address, stating experience and salary expected, ALBERT L. AREY, Free Academy, Rochester, N.Y.

WANTED.—A young man wishes a position in an experiment station. botanical department preferred. References and evidence of competency on application. Address E. E. BOGUE. Agr. Experiment Station, Columbus, O.

A UNIVERSITY GRADUATE IN SCIENCE, at present a junior student in medicine at the University of Michigan, desires a position as teacher or laboratory assistant. Special preparation in Zoology, Histology, Physiology and Human Anatomy. Will also teach, if desired, Physics, Chemistry, Botany, Entomology, Embryology, Bacteriology and Sanitary Science. References and full particulars on application. H. B., 20 East Jefferson St., Ann Arbor, Mich.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorlemmer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

I have a good supply of Eastern Coleoptera which I wish to exchange for species not in my collection. Melandryidae and Oedemeridae especially desired. Joe C. Thompson, Rosebank P. O., Box 73, S. I.

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1890 Seeger and Guernsey Cyclopedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost $6. David B. Lewis, Saybrook, Ill.

SCIENCE

NEW YORK, FEBRUARY 20, 1891.

THE ETRUSCAN-PELASGIAN PROBLEM.[1]

In the wavering twilight of the dawn of history a mysterious people is dimly discerned, occupying the peninsula of Greece, — the Pelasgians; and another, seen somewhat more clearly, owning or controlling the central districts of Italy,— the Etruscans.

Erudition has been exhausted with arguments as to the relationship of these peoples to others better known. Volumes have been written to prove them Aryans, Turanians, Semites, Egyptians, Iberians, Celts, and what not?

To both is assigned a singular degree of culture, and this with such certainty that we cannot deny that the mighty walls of Tiryns and Fiesole, the delicate gold-work from the tombs of Chiusi, and the exquisite alabasters from the cemeteries of Volterra, remain to us as achievements in art and architecture before which any thing accomplished in the same direction by Greek or Roman holds the second place.

Nor were the Etruscans, at least, an illiterate people, or negligent of the holy duty of setting down in permanent records the great and good deeds of the departed. They were indeed "most careful chief in that." Of the something more than six thousand inscriptions in their tongue and alphabet which we already have in hand, five-sixths of them are epitaphs or mortuary comments.

Yet with all this store of material, with many inscriptions bilingual, — Etruscan and Latin, — and with numerous descriptions in classic writers, we do not know, beyond peradventure, the meaning of a single word in the Etruscan language. What a fine field, therefore, for learned speculations!

Several such are before us. Dr. Hesselmeyer, already favorably known from an earlier archæological study, "Die Ursprünge der Stadt Pergamos" (1885), offers his solution of the problem by identifying the Etruscans and Pelasgians as members of the same linguistic family, which family he very positively decides belonged neither to the Indo-Germanic (Aryan), nor Semitic nor Turanian, branches of the human species. Further than this negative position, he will not advance, and denies the possibility of so doing, with our present knowledge. His identification of the Pelasgians with the Etruscans rests chiefly on the famous "inscription of Lemnos,"— an inscribed slab found on that island, undoubtedly Etruscan in origin, and dating from the sixth century B.C. Furthermore, a number of proper names, especially in the Ionian dialect of Greek, point, he contends, to an admixture of the language in early days with another of Etruscan character.

The most original part of Hesselmeyer's study is his tracing the migrations of the Pelasgo-Etruscans. The trend he finds was certainly from west to east, and from the seacoast toward the interior. Their colonies reached the shores of Asia Minor at a very early day, and their stations there led some of the Greek historians to believe the original home of the "Tyrrhenians" (as they were also called) was somewhere to the east. As Karl Otfried Müller has abundantly shown in his classical work, "Die Etrusker," the Etruscans themselves repudiated any such origin, and by their most ancient traditions claimed to have reached Italian soil by sea, from the south.

Although the leading German authorities wholly disregard this venerable legend, and insist that the ancestors of the Etruscans came across the Alps from some land to the north, an American scholar has recently insisted not less vigorously that the old legend is true, and has boldly connected it with a previously unthought-of origin of the Etruscans. As the result of his travels in ancient Numidia, now the French colony of Algiers, and ancient Etruria, the modern Tuscany, Dr. D. G. Brinton has developed the theory that the Etruscans were originally a Numidian or Libyan colony, allied in language to the ancestors of the modern Kabyles or Berbers, — a race who, at the dawn of history, occupied the whole of North Africa, from the Nile valley to the Atlantic Ocean.

His arguments, if not especially weighty on any one point, make amends by their diversity. They include the physical character, in reference to which he makes both Etruscans and Berbers tall and blond, to the confusion of our ordinary notions of both these peoples; their traditions; their political institutions; their culture; and, finally, their language. To the last named he gives particular attention, availing himself of the little-known Numidian inscriptions in the "tifinagh" alphabet, dating from about 200 B.C. Perhaps the most striking of his identifications is his interpretation of the Etruscan name of Servius Tullius, — "Mastarna." This appears to be clearly Numidian, and to mean "great conqueror."

Although Dr. C. Pauli of Leipzig, without doubt the most eminent "Etruscologist" now living, has entirely abandoned the Aryan or Indo-Germanic relationship of the Etruscan language, yet in the last year this effete hypothesis has again been advanced, with new arguments. Dr. Bugge, a learned Norwegian, has developed a suggestion offered thirty years ago by the late Dr. Robert Ellis of London, that the Etruscan was an Armenian dialect; and the odd combination of the president of the Royal Society of Literature, Sir Patrick Colquhoun, and the Turkish governor-general of the Libanus, Pasco Wassa Pacha, have appeared jointly in favor of identifying the Pelasgians with the Illyrians, the ancestors of the modern Albanians, who are also a member of the Aryan, or, as Penka prefers to call it, the "Aryac" family.

From the agreeable variety of these various learned solutions of the problem, all coming out within a twelve-month, it is quite evident that there is abundant chance yet for the learned to sharpen their wits on this much-vexed question.

[1] Dr. Ellis Hesselmeyer, Die Pelasgerfrage und ihre Lösbarkeit (Tübingen, 1890); Dr. Saphus Bugge, Etruscan and Armenian Researches in Comparative Language (Christiania, 1890); Dr. D. G. Brinton, Etruscan and Libyan Names. A Comparative Study (Philadelphia, 1890); Sir Patrick Colquhoun and H. E. Wassa Pacha, "The Pelasgi and their Modern Descendants," 1891 (Asiatic Quarterly Review).

Dr. Doremus has recently found, according to *The Engineering and Mining Journal* of Feb. 7, that sodium fluoride and other fluorides can be used with advantage for softening hard waters.

HEALTH MATTERS.

An Industrial Use of Microbes.

DR. NEILSON of Norway says that the Norwegian fisher-folk have for more than five hundred years used pathogenic bacteria in catching whales. A few miles from the town of Bergen there is a narrow inlet of the sea, into the mouth of which whales make their way every season. As related in the *Sanitary Inspector*, when a whale is discovered in this place, the alarm is given, and the fishermen put out in their boats, drive the whale farther up the narrow bay, and stretch a net across the mouth of the inlet. Through this the monster could easily break, but he does not. Then they proceed to capture him and bring him to land. The animal, however, is twenty or thirty feet long and very strong, and with their primitive implements alone this cannot be done. They therefore inoculate the whale with the poison of an infectious disease, and only after he is weakened as the result of the disease do they try to kill him. After the whale has been enclosed, the bowmen put out, and, when he comes to the surface to breathe, they shoot infected arrows into him and withdraw. After twenty-four or thirty-six hours the whale becomes less lively in his movements, and comes to the surface often to breathe. Then the real battle begins, and, after driving ten or twelve harpoons into the whale, the fishermen are able to land him. An examination of the places where the arrows were shot into the whale shows, in the immediate vicinity of some of them, a hemorrhagic infiltration of the muscular tissue, resembling very much the disease of land-animals called "sympathetic anthrax." The internal organs are normal. Once only Dr. Neilson found a bacillus in the blood-vessels of the spleen. Around the poisoned wounds vast numbers of a bacillus are found closely resembling that of sympathetic anthrax. When the arrows are pulled out of the wounds, many of these bacilli cling to them, and thus render them effective as "death-arrows" when further used. And thus the catching of whales goes on year after year, and has gone on for five hundred years. Dr. Neilson inclines to the opinion that the infection is the same as that of sympathetic anthrax, and hopes that later investigations may clear up the point.

Cocoanut-Water as a Culture-Fluid.

Dr. George M. Sternberg, writing in the *Medical News* of Sept. 13, 1890, says that he has used the juice of the unripe cocoanut as a culture-fluid, and found it very satisfactory. The idea occurred to him during a visit to Cuba that this fluid might be a useful culture-medium for bacteria, and upon making the experiment it was found that various species grew in it most luxuriantly. As it is contained in a germ-proof receptacle, no sterilization of the fluid is required when it is transferred with proper precautions to sterilized test-tubes, or is drawn directly from the nut into the little flask, with a long and slender neck, which is used for fluid-cultures. In these it may be preserved indefinitely, remaining perfectly transparent and ready for use. Heating the fluid causes a slight precipitate. In the investigations which have been made in Havana during the past two years, this fluid was used very extensively, and it was found a great convenience to have a sterile culture-fluid always at hand, ready for use at a moment's notice. Moreover, it has certain special advantages for the study of the physiological characters of various bacteria, and for the differentiation of species. It contains in solution about four per cent of glucose, in addition to vegetable albumen and salts, which alone would make it a useful nutrient medium. Certain micro-organisms multiply in it without appropriating the glucose, while others split this up, producing an abundant evolution of carbonic acid, and giving to the fluid a very acid re-action. As obtained from the nut, it has a slightly acid re-action, which makes it unsuitable as a culture-medium for certain pathogenic bacteria, but when desired it is a simple matter to neutralize it. For a large number of species of bacteria, and for the saccharomycetes, it constitutes a very favorable medium.

Micro-Organisms in Great Cities.

Professor Tarnier, in a course of lectures in 1890, referred to M. Miquel's researches on the relative abundance of micro-organisms in different places (*The British Medical Journal*). One to the cubic metre of air is the proportion at the top of a high mountain. It is stated in the *Medical Record* of Feb. 7 that in the Parc de Montsouris, in the south of Paris, M. Miquel found 400 micro-organisms to the cubic metre of air, while in the Rue de Rivoli the proportion was 3,480. In a new room in the Rue Censier he found 4,500 to the cubic metre; more, that is to say, than in the centre of Paris in the open air. In a room in the Rue Monge he counted 36,000, in the Hôtel Dieu 40,000, and in the Pitié, an older hospital, 319,000, micro-organisms to the cubic metre. At the Observatory, Montsouris, 650,000 microbes were found in a gram (15 grains) of dust; in the room in the Rue Monge the amount was 2,100,000. In the hospitals the proportion was so high, that counting the number of microbes in a whole gram of dust was found to be impossible. The dust is the great conveyer of micro-organisms. A 2 A.M., when a city is most quiet, the fewest germs are to be found in the air; at 8 A.M. the industry of domestic servants and dustmen has already made the air teem with germs; at 2 P.M. the proportion has again greatly fallen; at 7 P.M. it is once more high, for many houses are being "tidied up;" besides sundry kitchen operations are unhygienic. Thus the "small hours," unfavorable in many respects to patients hovering between life and death, are the least septic of the twenty-four. The day proportions indicate that household duties cause more septic diffusion than is excited by traffic and industry.

The Milk of the Egyptian Buffalo.

According to the researches of Messrs. Rappel and Richmond, of the Khedival Laboratory, Cairo, the milk of the Egyptian buffalo, or gamoose (*Bos bubalus*), presents several characteristics distinguishing it from that of the cow, which may well be remembered by medical men who have to treat patients, especially infants, in Egypt or in other countries where this animal is common. The amount of fat, as we learn from the *Lancet* of Aug. 23, 1890, was found to be a good deal larger than in cow's milk, the percentage in the specimens examined varying from 5.15 to 7.35. The sugar, which appeared to be a hitherto undescribed variety, differing from milk-sugar, was also found to be of larger amount than that in cow's milk, the average percentage being 5.41. It is suggested that this sugar should be called *tewfikose*. The fat, too, was found to differ from that of cow's milk, containing minute quantities of sulphur and phosphorus, and yielding four times as much caproic acid as butyric acid, whereas in cow's milk the quantity of caproic acid is only double that of butyric acid. The milk was also found to contain a small quantity of citric acid.

The Chemistry of the Tubercle Bacillus.

At the clinic of Professor Nothnagel a very interesting investigation on the chemical composition of the tubercle bacillus, says the *Lancet*, has been carried out by Dr. Hammerschlag, who had commenced his studies on the bacillus at Professor Nencki's chemical laboratory at Berne. Two analyses of two different culture series were made. The cultures were 0.2 to 3 months old, and 7.5 and 2.2 grams moist bacteria were obtained for the analyses. They contained between 88.7 and 83.1 per cent water, between 28.2 and 26.2 per cent substances soluble in alcohol and ether; i.e., lecithin, fats, and a poisonous substance which, injected subcutaneously into guinea-pigs, produced clonic spasms of the muscles, acceleration of pulse and respiration, and finally general convulsions and the death of the animal from twelve to fifty-one hours after the injection. The residue which remained after the extraction with ether and alcohol contained an albuminoid body and cellulose: therefore the tubercle bacilli seem to differ from other bacteria by the high percentage of substances soluble in alcohol and ether, as they contain between 26 and 28 per cent, while bacterium termo contains only 7.8, Friedländer's diplococcus only 1.7, and the bacillus anthracis only 7.8 per cent. It has been found that the presence of carbohydrates and glycerine is necessary for the growth of the bacilli, and that albumens alone are not sufficient as nourishing media for the tubercle bacillus, which differs thereby from the other bacteria. By experiments on rabbits, it was proved that a poisonous albuminoid body

is formed in the cultures by the bacilli, which (the dose used varied between 0.2 and 0.4 of a gram) produced, a few hours after the injection, a rise of temperature amounting to 1° or 2° C., lasting for one or two days, without any other effect even after repeated injections. The glycerine bouillon cultures lost their virulence on being kept for eight months at a temperature of 39° C., but they retained their vital activity. In experiments made on animals with such cultures of eight months' standing, only negative results were observed with regard to the production of immunity in animals by such cultures; and Hammerschlag, Falk, and Charrin have failed to produce a protective inoculation.

Physical and Chemical Changes in the Blood in Disease.

Dr. Sciolla of Genoa, at the Congress of the Italian Society of Internal Medicine, reported some interesting experimental rerearches on physico-chemical changes of the blood in different morbid conditions. He stated, according to the *Lancet*, that the density of the blood diminishes during acute febrile states and the first stages of convalescence, increasing afterward with greater or less rapidity according to the nature of the disease. The same thing is always observable in the density of blood-serum, with this difference, that it begins to increase as soon as there is any improvement in the condition of the patient; sometimes, indeed, a short time previously. The density of the serum is increased in malaria, while that of the blood is diminished. Tuberculous affections, unaccompanied by serious alterations of the blood, only slightly modify the density of blood-serum and blood. The densities of blood-serum and blood are both diminished in catarrhal jaundice, probably owing to defective assimilation of food. The density of the blood is almost normal, while that of the serum is increased, in cirrhosis of the liver and in cancer of the gall-bladder. The densities of blood and serum are not sensibly diminished in benign forms of diabetes. The greatest diminution in the density of the blood is observable in diseases accompanied by grave morbid changes of the blood. The most striking examples were those seen in three fatal cases of pneumonia. Dr. Sciolla also observed the chemical modifications of the blood in pneumonia, typhoid-fever, malaria, anæmia, and in leucæmia. About the fourth or fifth day of croupous pneumonia there is a marked diminution in the albuminoid substances of the blood, especially the globulin. The extractive matters increase during the febrile period. In convalescence the quantity of albuminoids, especially of the globulin, and also that of the serin, increased. The dry residue of the blood is not much diminished during the first stage of the disease, but it so during the second stage, and continues less until convalescence. In typhoid-fever the albumens of the blood diminish progressively (unless the diarrhœa is excessive), and this diminution occurs at the expense of the serin. The extractive matters gradually diminish during the whole of the febrile period, and even during the early stage of convalescence. In malarial fevers the amount of the albuminoids in the blood-serum (especially the serin, and in a less degree the globulin) and the dry residue of the blood diminish rapidly, while the dry residue of the serum and the extractive matters of the serum increase with the duration of the fever,—the former in a slight degree, the latter enormously. In chloro-anæmia the albumens of the serum (especially the globulin) and the dry residue of the blood diminish, while the dry residue of the serum increases. In leucæmia the amount of dry residue of the serum is very high, and the albuminoids of the serum are also above the normal, the serin being especially increased.

NOTES AND NEWS.

THE expedition which is to be sent in the spring to the west coast of Greenland, by the committee of the Karl Ritter Endowment, is likely to be one of considerable importance. The chief of the expedition, as we learn from *Nature* of Feb. 5, will be Dr. E. von Drygalski; Dr. O. Baschin will accompany it, defraying his own charges; and there will be a third scientific expert, who has not yet been selected. Dr. von Drygalski proposes to establish a station near the Umanackfjord, in about 70° 30′ north latitude, where Dr. Baschin will carry out a continuous series of meteorological observations, and from which he can make long or short excursions inland to study the interior ice. It is expected that the party will remain in Greenland about a year.

— Two Frenchmen, Dr. Besson and Père Tulazac, have succeeded in making the first ascent to the summit of Ambondrombo, dreaded by the Betsileos as sacred, or *tabu*. They, however, found five Betsileos willing to accompany them to the top. According to the January "Proceedings of the Royal Geographical Society," the party started from Ambosary, the nearest village to the mountain, and reached the summit in seven hours. Axes and knives had frequently to be used to clear the way. The mountain is rugged and wooded, reaching a height of 6,234 feet. The party had to cross many ravines during the ascent.

— From Dorsetshire, England, a singular instance of starlings being eaten by rooks is reported (*Nature*, Feb. 5). It seems that during the very severe weather there this winter, a flock of starlings was observed on a farm at West Stafford, near Dorchester, followed by a number of rooks in hot pursuit. The larger birds soon came up with their prey, and quickly despatched them, and, after stripping them of their feathers, devoured them then and there. When the scene of the occurrence was inspected just afterwards, the ground was found to be strewn with their feathers, but beyond these not a vestige of the starlings could be discovered. It seems that the rooks, from sheer hunger, must have been driven to this extremity, owing to the scarcity of other kinds of food.

— A method of repairing incandescent lamps, the invention of a M. Pauthonier, is described in a recent number of *L'Electricien*. The lamp to be repaired is first taken to a glass-blower, as quoted in *Engineering* of Feb. 6, who pierces a hole in the bulb sufficiently large to allow of the old filament being taken out and a new one inserted. From the hands of this workman the lamp passes to a second, who cuts off the ends of the broken filament and removes it, taking care, however, at the same time to leave about one millimetre of the filament at each of the platinum electrodes; and it is to these short lengths of the old filament that the new one is welded. This is done by filling the bulb with a liquid hydrocarbon, after which the new filament, which has been previously standardized, is introduced. One end of the filament is then pressed against the fragment of the old one already referred to, and a current passed through the joint. The hydrocarbon is decomposed, and a deposit of solid carbon occurs round the joint, and securely fastens the new filament in place. The other end of the filament is joined to the other electrode in the same way. The next process is the bleaching of the glass, which is so thoroughly done that the glass of the repaired lamps is said to be more brilliant and transparent than that of perfectly new ones. The repaired lamps are said to last quite as long as new ones, to which they are in no respect inferior. The process is said to be peculiarly adapted to the repair of lamps of the "Sunbeam" type.

— To stimulate the collection of photographs to be used in showing the need of improved roads in the United States, the Connecticut division joins the New York division of the League of American Wheelmen in offering three prizes aggregating $100, as follows: one prize of $50 for the best collection of not less than three photographs, one prize of $30 for the second best collection of not less than three photographs, one prize of $20 for the third best collection of not less than three photographs. There are wanted photographs showing the common spectacle of the farmer's team and wagon, hub-deep and knee-deep in the muddy road; photographs showing rough, rutty, and muddy roads in their worst condition; photographs showing the every-day break-down caused by rough or muddy roads or steep grades; photographs showing smooth, hard surfaced roads and (if possible) teams hauling loads over the same; and other pictures illustrating the goodness of good roads and the badness of bad roads. The prizes will be awarded before May 15, 1891. Further information will be furnished on application to either Isaac B. Potter, 278 Potter Building, New York, N.Y., or Charles L. Burdett, Hartford, Conn.

— According to the latest observations which Dr. Finsterwalder has published, as stated in *The Scottish Geographical Magazine* for February, the region occupied by advancing glaciers is extending from west to east, and has lately crossed the limits of the eastern Alps. The glaciers in this region have been receding during the last thirty years, but now there is undeniable proof that those of the Ortler group, at any rate, are in a state of progression.

— Assistant E. D. Preston of the United States Coast and Geodetic Survey will soon go to the Hawaiian Islands for the purpose of making a series of latitude observations, to be used in connection with others to be made by several of the countries who are connected with the International Geodetic Association. The question of a change in the position of the earth's axis has led to some special refinements in the method of observing astronomical latitudes. Whatever may be the cause of the supposed motion of the pole, whether it results from the shifting of volumes of the atmosphere or water above the surface, or the movement of liquid or semi-liquid masses within the earth's crust, the quantity to be measured is so small that it is necessary to reduce the uncertainty of the determination to a very few feet. The observations at Honolulu soon to be taken up simultaneously by the United States Coast and Geodetic Survey and the International Geodetic Association of Europe will decide whether the variation is a purely local one or whether there is a real change in the position of the axis of rotation. Observations made last year in Europe, and also in this country by Professor Comstock at Madison, Wis., seem to indicate that there is an interference between the motions of the axis of rotation and the axis of inertia, producing a maximum every year in the mean motion, and a larger maximum at the end of five years. In Europe the minimum of 1890 was 0.20″ smaller than the minimum of 1889. Besides, the Greenwich observations of latitude for the last sixty years show there is a long period of inequality of at least this length. In order to bring out these small changes, the following precautions will be taken in the execution of the work: no zenith distances greater than 30° will be used, and differences of zenith distances shall not be more than 12′; stars will be chosen so that any error in the value of the micrometer-screw will be eliminated, and the preference will be given to stars whose proper motions are well known; the barometer and thermometer will be read in order to note atmospheric changes. The Coast and Geodetic Survey representative, Mr. Preston, will also avail himself of the opportunity to make magnetic and gravity observations at a number of points on the islands, including one station on the summit of Mauna Kea at an elevation of 14,000 feet. Some meteorological observations will probably be made as well. The following instruments will be taken: a zenith telescope for the regular international latitude work, a meridian telescope (or combination instrument) for time and latitude observations at the pendulum stations, and a theodolite-magnetometer and dip circle for magnetic observations. The pendulums for the gravity observations will be of a new pattern, very portable, and will be observed by means of an elegant method of coincidences devised by Professor Mendenhall.

— The monthly report for January of Arthur Winslow, State geologist of Missouri, states that only such field-work has been done as was necessary to complete those divisions of work which were included among the operations of the past season. Thus, in Jackson County some little field-work was done to complete the examination of the clay and building-stone industries of the western counties; and in Randolph, Howard, and Lafayette Counties instrumental levelling was done in order to determine the altitudes of various coal-beds. But the bulk of the work during the past month has been in the office, where the members of the survey are engaged in plotting the results of surveys made during the past summer and autumn. In addition, they have been busy correcting the proof of Bulletin No. 3, and in preparing the manuscript of the biennial report and of Bulletin No. 4 for the printer. Bulletins Nos. 2 and 3 have been printed, and about a thousand copies of each have been distributed. Bulletin No. 2 is a bibliography of the geology of Missouri, the manuscript of which was prepared and donated to the survey by Mr. F. A. Sampson of Sedalia. It is a valuable work of reference, and will be of great use to all who are interested in the geology of Missouri and her minerals. Bulletin No. 3 contains papers on the clay, stone, lime, and sand industries of St. Louis City and County, and on the mineral waters of Johnson, St. Clair, Henry, and Benton Counties. These papers contain a mass of facts concerning the subjects to which they relate, in addition to statistics of production. They are, however, provisional publications; and the results of analyses and tests now in progress, together with other matter not yet ready for presentation, are reserved for the final report on these special subjects, which it is hoped will be prepared this year. In the laboratory, analyses of clays and mineral waters have been prosecuted, and 186 determinations have been made. In addition, a number of substances sent in by various citizens of the State have been determined and reported upon.

— The third annual meeting of the Association of American Anatomists was held Dec. 29 and 30, 1890, in the anatomical lecture-room of the Harvard Medical School, Boston, Mass. It was presided over by Dr. F. D. Weisse, second vice-president, and Dr. Thomas Dwight acted as secretary *pro tem.* Papers were read as follows: "Corrosion Preparations," by Dr. S. J. Mixter; "Studies on the Spine," by Dr. Dwight; "A Comparison of the Fibrine Filaments of Blood-Lymph in Mammalia and Amphibia," by Professor S. H. Gage; "The Semi-Lunar Bone," by Professor Shepherd; "The Structure of Protoplasm and Mitosis," by Dr. Carl Heitzmann; "The homology of the Cerebrospinal Arachnoid with the Other Serous Membranes," by Professor F. W. Langdon; "The Occlusion of the Rhinocœle (Olfactory Ventricle) in the Dog," by Mr. P. A. Fish; and three papers—"The Relations of the Olfactory to the Cerebral Portion of the Brain," "The Brains of a Cat and of a Sheep lacking the Callosum," "Owen's Nomenclature of the Brain, with Suggestions based Thereon"—by Professor B. G. Wilder. With one exception, the papers were illustrated by specimens, photographs, or diagrams, and all were fully discussed. The committee on anatomical nomenclature (Professors Leidy, Harrison Allen, Frank Baker, Thomas Dwight, T. B. Stowell, and B. G. Wilder) were authorized to publish as their second report "such general and specific recommendations as may be unanimously agreed upon by them." The following were elected members: Dr. W. W. Dana of Portland, Me.; Dr. John C. Munro of Boston, Mass.; Mr. Pierre A. Fish of Ithaca, N.Y. The next meeting will be held at Washington, D.C., in September, 1891, at or about the time of meeting of the Congress of American Physicians and Surgeons. The officiers for that meeting are as follows: president, Joseph Leidy; vice-presidents, Frank Baker, F. D. Weisse; secretary and treasurer, D. S. Lamb; executive committee, Harrison Allen, Thomas Dwight, and B. G. Wilder.

— It is reported, says *The Engineering and Mining Journal*, that an organization is in progress of formation at Youngstown, O., which will be one of the strongest in iron circles in the United States, representing an investment of $7,735,000. The body will be known as the Mahoning & Shenango Valley Iron Manufacturers' Association, and includes the iron manufacturers of both valleys. These concerns include twenty-two furnace stacks, thirteen rolling-mills, one pipe-works, and one wash-metal plant. The output of pig iron is 1,200 tons annually and 450,000 tons of finished iron, while the number of men employed will exceed 2,000. It is the first time in the history of the iron business in eastern Ohio and western Pennsylvania that the iron manufacturers have been united.

— M. H. Coudreau has completed the first part of the mission of exploration in the basin of the river Oyapock, Guiana, with which he was intrusted by the French Government. The traveller, when among the mountains of Emerillons, between the Inipi and the Appronague, was abandoned by his guides. This misfortune, which occurred in January, 1890, caused the loss of much valuable time, so that the work of exploration had to be undertaken during the rainy season. The results of this winter campaign are as follows ("Proceedings of the Royal Geographical Society," Jan.): The seven chief affluents of the Oyapock, which

drain the whole of the south east of the country, were surveyed on the scale 1:100,000: five out of the seven were ascended by the traveller up to their sources. His surveys include about 430 miles of quite unexplored country, besides 235 miles of new work on the Oyapock. Two of these tributaries carried him right into the heart of the Tumuc Humac Range, where he was able to study the native languages. He has collected twenty-five hundred words of the Oyampi language. The whole of the south-east region abounds in marshes, and presents a desolate picture. On all sides are the ruins of Indian villages. Small-pox and dysentery, and a steady emigration to the south-west of the country, are rapidly thinning the population; so that a generation hence, M. Coudreau says, the south east will be practically uninhabited. The Creoles may, however, be attracted to this region on account of its auriferous character, but it will not be easily exploited owing to the numerous falls in the rivers. In July last the travellers was about to start upon the second portion of his work. He intended to navigate the Oyapock to its source, cross the Tumuc Humac Mountains to the southern side, and visit the Indians living near the sources of the Tapanahony by a new route. Thence he will reach the Itany, descend the Aoua, and return across the whole central part of French Guiana. This central journey will occupy eight months.

— A course of five lectures on the ethnology of modern Europe, by Dr. D. G. Brinton, was begun Monday afternoon, Feb. 16, at the Academy of Natural Sciences of Philadelphia. The subjects of the different lectures are as follows: 1. "The Predecessors of Modern European Nations;" 2. "The Romance and Hellenic Nations (France, Spain, Portugal, Italy, Greece, etc.);" 3. "The Teutonic Nations (Germans, Danes, Swedes, English, etc.,—Celtic Remnants);" 4. "The Slavonic Nations (Russians, Poles, etc.);" 5. "The Allophyllic Peoples (Basques, Finns, Hungarians, Turks, etc.)." These lectures are free, and tickets may be obtained of the secretary of the academy, Dr. E. J. Nolan.

— In a communication to the French Physical Society, M. Cailletet has described a method of connecting a metal tube or stop-cock to a vessel of glass or porcelain so that the joint shall be tight even under high pressures. As described in *Engineering*, the process is simple, and consists in first coating the glass or porcelain vessel with a very thin layer of platinum at the part where the connection is to be made. This may be done by painting the glass, after slightly warming it, with a neutralized solution of platinic chloride mixed with the essential oil of camomile. The layer of oil and platinic chloride is then slowly heated till the last traces of oil have been expelled, and the temperature is then raised to a dark-red heat. The chloride is thus reduced, and the platinum deposited as a bright metallic mirror on the surface of the glass. On this layer of platinum a second layer of copper is deposited by electrolysis, and the metal stop-cock or tube can then be soldered by means of tin to this copper ring. M. Cailletet states that he has found these joints to remain tight under a pressure of 300 atmospheres.

— A theory attempting to explain the nature of the relationship between the optical activity of many substances in solution, and the hemihedrism of their crystalline forms, is advanced by Dr. Fock, the author of the new work on chemical crystallography, in *Berichte*, and quoted in *Nature* of Feb. 5. It is certainly a most significant fact that all those substances whose solutions are capable of rotating the plane of polarization of light, and whose crystalline forms have been thoroughly investigated, are found to form hemihedral crystals; that is to say, crystals some of whose faces have been suppressed, and whose two ends are therefore differently developed. Moreover, in those cases where both the right rotatory and left rotatory varieties of the same chemical compound have been isolated and examined, as in the case of dextro- and lævo-tartaric acid, the hemihedral crystals are found to be complementary to each other, the faces undeveloped upon the one being present upon the other, so that the one is generally as the mirror-image of the other. Several ingenious attempts to account for the wonderful geometrical arrangement of the molecules in a crystal have been made of recent years by Bravais, Mallard, and others, who developed the "Raumgitter" theory, and by Sohncke, who showed that all possible crystallographical forms could be referred to systems of points; yet it has been found necessary by these crystallographers to assume a polarity of the molecule itself in order to fully explain the phenomenon of hemihedrism. This conclusion is, moreover, borne out by the more recent work of Lehmann upon his so-called "liquid crystals." It is, indeed, evident that hemihedral crystals owe their hemihedrism to a differentiation of the various parts of the molecules themselves in space. Dr. Fock assumes, for the purpose of connecting this fact with the optical rotation of the dissolved crystals, the tetrahedral form for the element carbon, in the most recent conventional sense employed by Wislicenus, Van't Hoff, Victor Meyer, and other exponents of the new "stereo-chemistry." The axis of polarity of a molecule containing an asymmetric carbon atom, will, of course, be determined by its centre of gravity and the heaviest "corner" of the tetrahedron; and Dr. Fock shows that rotation of the molecule will be most easy round this axis, and in the direction, right or left, determined by the relative weights of the atoms or groups disposed at the other three "corners." He further shows, that, if we consider any direction of vision through the solution, we must practically consider two positions of the molecules, in both of which the axis of rotation is parallel with our line of sight, and in one of which the apex of the tetrahedron is turned towards us, and in the other is directed away from us and the other three corners presented to us. As the molecules are, of course, in rapid motion, we must consider all other positions as balancing each other, and being resolved eventually into these two directions. It is then easy to see, as it is now accepted from Fizeau's work that the movement of molecules is capable of influencing the direction of light-waves, that there must be two oppositely moving circularly polarized rays produced. Now, it is generally supposed that the rotation of liquids is really due to the division of the light into two circularly and oppositely polarized rays, one of which, however, is stronger than the other, and determines the apparent optical activity. Dr. Fock completes his theory by showing the probability that there would be just this difference in the amount of rotation of the light in the two cases of the differently disposed molecules, those with their "apices" turned towards the direction of incidence of the light affecting it to a different extent from those whose "bases" were the first to receive it. The theory is well worth following out in the original memoir, many confirmations of it being adduced from other properties of hemihedral crystals.

— Señor Felipe Poey, the renowned Cuban philosopher and naturalist, is dead. He was born in Havana, May 26, 1799, and studied law in Madrid, where he was implicated in a political conspiracy, and from whence he fled to Paris. There he published in 1828 "La Centurie des Lépidoptères," and helped to found the French Entomological Society. He returned to Havana after the revolution of 1830, was commissioned in 1837 to organize a museum of natural history, and became one of its directors. Soon afterwards he was appointed professor of natural history in the University of Havana. In 1840 he published a school geography of the Island of Cuba, and in 1842 a more extensive work on the same subject, and a "Geografia Universal." In 1864 he published "Memorias Sobre la Historia Natural de la Isla de Cuba," with Spanish, French, and Latin text. In 1865 he started a monthly periodical entitled *Repertorio Fisico-Natural de la Isla de Cuba*, in which he described upward of two hundred and thirty new species of fishes, as well as the *ciguatera*, or jaundice, caused by eating certain Cuban fishes. He also published some remarkable poems. He was a member of the Smithsonian Institution, and a corresponding member of the French Academy of Sciences.

— Some time ago M. Berthelot, judging from a text of the eleventh century, formed the opinion that the word "bronze" was derived from "Brundusium," or Brindisi. We learn from *Nature* of Jan. 29 that this view has been confirmed by the discovery of a passage in a document of the time of Charlemagne, where reference is made to the "composition of Brundusium;" copper, two parts; lead, one part; tin, one part. It would appear that at Brundusium bronze was in ancient times manufactured on a great scale.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

THE SOUTH AFRICAN DOCTRINE OF SOULS.[1]

IN the second of two interesting papers on the manners, customs, superstitions, and religions of South African tribes (*Journal of the Anthropological Institute*, vol. xix. No. 3, and vol. xx. No. 2), the Rev. James Macdonald, who has had ample opportunities of studying the subject, has a good deal to say about the doctrine of souls which prevails among the aborigines of South Africa. It is extremely difficult, he explains, to discover what the people really believe about the spirit-world, so many and varied are the traditions relating to it. There are, however, certain outstanding facts common to all; and of these Mr. Macdonald gives a clear and instructive account.

All human beings are supposed to have souls, but their souls are not believed to be entirely confined to the body. A man's soul may, it is thought, occupy the roof of his hut; and, if he changes his residence, his soul does so at the same time. Mr. Macdonald takes this to be a loose and indefinite way of expressing "the belief that a man's spirit may have influence at a distance from the place where he is himself at any time." The people often use the word "zitunzela," from "izitunzi" ("shadows"), to express their ideas of human spirits and the unseen world generally; and this is "the nearest description that can be obtained." A man is constantly attended by the shadows or spirits of his ancestors as well as his own, but the spirit of one who dies without speaking to his children shortly before death never visits his descendants except for purposes of evil. In such cases magicians or priests offer costly sacrifices to prevent misfortune and death.

Great importance is attached to dreams or visions, which are supposed to be due to spirit influence. When the same dream comes more than once, the dreamer consults the magicians, who profess to receive revelations through dreams. If the dreamer has seen "a departed relative," the magician says, "He is hungry." Then a beast is killed; the blood is collected, and placed in a vessel at the side of the hut farthest from the door; the liver is hung up in the hut, and must not be eaten until all the flesh of the animal has been used. The "essence" of the food is "withdrawn" by the spirit during the night, and after a specified time all may be eaten except the portions which the magician orders to be burned.

Ancestor-worship is not only professed by the South African tribes, but "they actually regulate their conduct by it." Says Mr. Macdonald,—

"If a man has a narrow escape from accident and death, he says, 'My father's soul saved me,' and he offers a sacrifice of thanksgiving accordingly. In cases of sickness, propitiatory sacrifices are offered to remove the displeasure of the ancestors, and secure a return of their favor. Should any one neglect a national custom in the conduct of his affairs, he must offer sacrifice to avert calamity as the consequence of his neglect. When offering propitiatory sacrifices, the form of prayer used by the priest is, 'Ye who are above, accept our offering and remove our trouble.' In freewill offerings, as in escape from danger, or at the ripening of crops, the prayer takes the following form: 'Ye who are above, accept the food we have provided for you, smell our offering now burning, and grant us prosperity and peace.'"

Animals are not supposed to have souls, neither are inanimate objects; but spirits may reside in inanimate objects, and their presence has an influence on many customs and habits. A striking example of such influence was afforded during the rebellion of 1879, when Umhlonhlo, after the murder of the British Resident, was one day marching in a leisurely manner across country with his whole army. The forenoon was hot, and not a cloud was to be seen. Presently the magicians noticed on the horizon a peculiarly shaped cloud. "It rose rapidly in one mass, and 'rolled upon itself.' Its movements were intently watched till it approached the zenith and passed over the sun. This was an evil omen. For some unknown cause the spirits were mortally offended, and had come over the army in shadow at noonday. In grief and sorrow their backs were turned upon their children, and the result of this would be certain defeat and disaster. There was, however, no immediate danger. That morning's scouts had reported that there were no troops within many miles of their line of march, and they could repair to some sacred place to offer sacrifices and make atonement. While they were discussing which place to repair to for this purpose, the van of a small column of cavalry appeared unexpectedly over a rising ground. Dismay struck into every heart. The war minister urged his men to form into order of battle. No one answered his summons. He did his best to organize an orderly retreat, but in vain. Not a blow was struck, and every man took to his heels, making for the nearest hiding-place in mountain or forest. That army never re-assembled. Black-hearted fear utterly demoralized it."

Water or river spirits play a great part in South African mythology. They inhabit deep pools where there are strong eddies and under-currents. They are dwarfs, and are of a malignant disposition, which they display by greedily seizing on any one who comes within their reach. They are, of course, greatly feared; and the popular dread of them is shown in a way which has been known in many different parts of the world. Mr. Macdonald gives the following example: —

"Some years ago a number of Gcaleka girls were, on a fine summer day, bathing in the Bashee. One of them got beyond her depth, and began to struggle in the water, and cry for help. Her companions promptly raised the alarm, and two men working close by ran down to the water's edge. She was still struggling feebly, but to the onlookers it was a clear case of being 'called' by the river, and they made no attempt to save her. The body was recovered by the magicians the same day, when it was found she had been drowned in less than five feet of water. All this came to the ears of C. G. H. Bell, Esq., the English Resident; and he cited the parties, magicians and all, to appear before him in court. The two men not only admitted that they could have waded to the spot where they saw her struggling, but also said the water would not be 'more than breast deep.' They had made no effort to save her, as it would be 'improper and dangerous to interfere when one is called by the river.' Mr. Bell tried to argue them out of such absurd notions, but to little purpose, and finally came to the conclusion that 'six months hard' might be more effectual in eradicating superstition than all his philosophy, and six months hard it accordingly was."

Mr. Macdonald says there is no periodical process of purging or driving away spirits. Without the presence and aid of magicians, ordinary people dare not interfere with these mysterious powers, however malignant and destructive they may become. Although a man is guarded by the spirits of his ancestors, they do not protect him from demons or from wizards and witches. A certain

[1] From Nature.

measure of protection can, however, it is supposed, be obtained by the use of charms provided by magicians. On one occasion, when war was being carried on with England, the magicians gave the soldiers a charm against English bullets. It was the blue flower of a species of rhododendron. "Those who carried this talisman rushed forward against columns of infantry without a shadow of fear or hesitation; and only when men began to bite the dust in all directions did the nature of the delusion break upon the army, and panic ensue."

DEAF-MUTE INSTRUCTION.[1]

THE Sundry Civil Bill grants $52,500 to the Columbia Institution for the Deaf and Dumb, an increase of $5,000 over former appropriations.

President Gallaudet says, "The object of this increase is to enable the directors to enlarge the facilities afforded in the institution for normal instruction. For many years the graduates of our collegiate department have been in demand as teachers of the deaf in the primary schools of the several States. The demand for such teachers has far outgrown our limited supply; and as no normal school for the training of teachers of the deaf exists in this country, while several are sustained in Europe, it has been thought extremely desirable that the advantages for normal instruction existing in this institution to a limited degree should be increased."

In accordance with your suggestion, I submit herewith a brief statement of my reasons for opposing this grant, and trust you will allow me a hearing before your committee: —

1. The proposed normal department is a new departure, which will probably lead to largely increased appropriations in the future, diverting public money to an object foreign to the purposes for which the institution was established.

2. Such a training-school for teachers, supported by the National Government, will interfere with that healthy competition which now exists between rival methods of instructing the deaf.

3. In the Columbia Institution a foreign language (the sign-language) is used as the medium of instruction, whereas the rival methods employ the English language alone for this purpose.

4. The graduates of the collegiate department are, of course, deaf. The institution, therefore, proposes to train deaf persons to teach the deaf. This is a backward step, detrimental to the best interests of the deaf, and subversive of the very object for which the collegiate department exists.

5. Great efforts are now made to teach deaf children to speak; and articulation teachers are employed in all important schools for the deaf, with the exception of the collegiate department of the Columbia Institution.

6. The president of the Columbia Institution has stated that lack of funds alone prevents the employment of special articulation teachers in the National College. The increased appropriation of $5,000 now asked for would, if applied to this purpose, not only enable the collegiate department to employ ordinary teachers of articulation, but also a professor of elocution, who could carry up articulation work to the highest point of perfection attainable by the deaf.

7. I would gladly support an application for $5,000, to be expended for the employment of articulation teachers and a professor of elocution in the collegiate department of the institution, but I would strongly oppose an application for the purposes set forth by President Gallaudet.

REPORT OF PROGRESS IN SPECTRUM WORK.[2]

DURING the past year or two a great deal of work has been done in the photography of the spectra of elements and the identification of the lines in the solar spectrum, which it will take a long time to work up, ready for publication: hence I have thought that a short account of what has been done up to the present time might be of interest to workers in the subject. In the prosecution of the work, financial assistance has been received from the Rumford Fund of the American Academy of Arts and Sciences, as well as from the fund given by Miss Bruce to the Harvard Astronomical Observatory for the promotion of research in astronomical physics, and the advanced state of the work is due to such assistance.

The work may be summed up under the following heads: —

1. The spectra of all known elements, with the exception of a few gaseous ones, or those too rare to be yet obtained, have been photographed in connection with the solar spectrum, from the extreme ultra-violet down to the D line, and eye-observations have been made on many to the limit of the solar spectrum.

2. A measuring-engine has been constructed with a screw to fit the above photographs, which, being taken with the concave grating, are all normal spectra and to the same scale. This engine measures wave-lengths direct, so that no multiplication is necessary, but only a slight correction to get figures correct to $\frac{1}{100}$ of a division of Angstrom.

3. A table of standard wave-lengths of the impurities in the carbons, extending to wave-length 2000, has been constructed to measure wave-lengths beyond the limits of the solar spectrum.

4. Maps of the spectra of some of the elements have been drawn on a large scale, ready for publication.

5. The greater part of the lines in the map of the solar spectrum have been identified, and the substance producing them noted.

6. The following rough arrangement of the solar elements has been constructed entirely according to my own observations, although, of course, most of them have been given by others: according to intensity, calcium, iron, hydrogen, sodium, nickel, magnesium, cobalt, silicon, aluminum, titanium, chromium, manganese, strontium, vanadium, barium, carbon, scandium, yttrium, zirconium, molybdenum, lanthanum, niobium, palladium, neodymium, copper, zinc, cadmium, cerium, glucinum, germanium, rhodium, silver, tin, lead, erbium, potassium; according to number, iron (2000 or more), nickel, titanium, manganese, chromium, cobalt, carbon (200 or more), vanadium, zirconium, cerium, calcium (75 or more), scandium, neodymium, lanthanum, yttrium, niobium, molybdenum, palladium, magnesium (20 or more), sodium (11), silicon, strontium, barium, aluminum (4), cadmium, rhodium, erbium, zinc, copper (2), silver (2), glucinum (2), germanium, tin, lead (1), potassium (1); doubtful elements, iridium, osmium, platinum, ruthenium, tantalum, thorium, tungsten, uranium; not in the solar spectrum, antimony, arsenic, bismuth, boron, nitrogen (vacuum tube), caesium, gold, indium, mercury, phosphorus, rubidium, selenium, sulphur, thallium, praeseodymium; substances not yet tried, bromine, chlorine, iodine, fluorine, oxygen, tellurium, gallium, holmium, thulium, terbium, etc.

These lists are to be accepted as preliminary only, especially the order in the first portion. However, being made with such a powerful instrument and with such care in the determination of impurities, they must still have a weight superior to most others published.

I do not know which are the new ones, but call attention to silicon, vanadium, scandium, yttrium, zirconium, glucinum, germanium, and erbium, as being possibly new.

Silicon has lines on my map at wave-lengths 3905.7, 4103.1, 5708.7, 5772.3, and 5948.7. That at 3905.7 is the largest and most certain. That at 4103.1 is also claimed by manganese.

The substances under "not in the solar spectrum" are often placed there because the elements have few strong lines or none at all in the limit of the solar spectrum when the arc spectrum, which I have used, is employed. Thus boron has only two strong lines at 2497. Again, the lines of bismuth are all compound, and so too diffuse to appear in the solar spectrum. Indeed, some good reason generally appears for their absence from the solar spectrum. Of course, this is little evidence of their absence from the sun itself.

Indeed, were the whole earth heated to the temperature of the sun, its spectrum would probably resemble that of the sun very closely.

With the high dispersion here used, the "basic lines" of Lockyer are widely broken up, and cease to exist. Indeed, it would

[1] Open letter of Alexander Graham Bell to Hon. William B. Allison, chairman of the Senate Committee on Appropriations, dated at Washington, D.C., Feb. 11, 1891.

[2] From Johns Hopkins University Circulars.

be difficult to prove any thing except accidental coincidences among the lines of the different elements. Accurate investigation generally reveals some slight difference of wave-length or a common impurity.

Furthermore, the strength of the lines in the solar spectrum is generally very nearly the same as that in the electric arc, with only a few exceptions, as, for instance, calcium. The cases mentioned by Lockyer are generally those where he mistakes groups of lines for single lines, or even mistakes the character of the line entirely. Altogether there seems to be very little evidence of the breaking-up of the elements in the sun, as far as my experiments go.

Even after comparing the solar spectrum with all known elements, there are still many important lines not accounted for. Some of these I have accounted for by silicon, and there are probably many more. Of all known substances, this is the most difficult to bring out the lines in the visible spectrum, although it has a fine ultra-violet one. Possibly iron may account for many more, and all the elements at a higher temperature might develop more. Then, again, very rare elements, like scandium, vanadium, etc., when they have a strong spectrum, may cause strong solar lines, and thus we may look for new and even rare elements to account for very many more. Indeed, I find many lines accounted for by the rare elements in gadolinite, samarskite, and fergusonite other than yttrium, erbium, scandium, praeseodymium, neodymium, lanthanum, and cerium, which I cannot identify yet, and which may be without a name. For this reason, and to discover rare elements, I intend finally to try unknown minerals, as my process gives me an easy method of detecting any new substance or analyzing minerals however many elments they may contain.

The research is much indebted to the faithful and careful work of Mr. L. E. Jewell, who has acted as my assistant for several years. Preliminary publications of results will be made in the *University Circulars*.

Among the latest results I may mention the spectroscopic separation of yttrium into three components, and the actual separation into two. HENRY A. ROWLAND.

DUTCH BORNEO.[1]

LITTLE is known of the interior of the Island of Borneo, and therefore the information supplied by Heer S. W. Tromp in the *Tijdschrift van het Kon. Nederlandsch Aardrijkskundig Genoot.*, Deel vii. No. 4, though incomplete, is very acceptable. In 1885 he steamed up the Mahakam River to Muvara-Pahu, a village about 190 miles from the sea. Near the coast the land is flat, and is being laid out in rice-fields. It would also, in Heer Tromp's opinion, be suitable for the cultivation of sugar-cane. Farther up the river, hilly country is entered, covered with a layer of yellowish-red soil, of little value for agriculture. After eight hours' steaming from Samarinda, Heer Tromp passed the mouth of the Sebulu River, and two hours and a half later reached Naga-Beulur. Here the hills, which extend from Pelarang (a short distance below Samarinda), suddenly terminate, and the river emerges through a narrow channel from a level tract, stretching northwards probably to the frontier of Berau, which was formerly the bed of a large lake. Even now this depression is not entirely filled up. Meres and morasses of large area lie on either side of the Mahakam, and when the water is high, that is, during the greater part of the year, a large proportion of the country is submerged. The district of the Upper Mahakam is inhabited by a tribe of Dyaks, known as Bahau-Dyaks in Kutei, and elsewhere as Pari-Dyaks. Their number is estimated at 4,500. Formerly they were notorious head-hunters, and were much dreaded in the Baritu valley, but of late greater security has been established by the interference of the Sultan of Kutei.

The development of the country, however, has not been accelerated thereby, for, with the festivals held on the bringing-home of heads, has also disappeared the stimulus to industry. Large sums were formerly expended in gala-dresses for the women, of silk adorned with beads; and tobacco and rice were provided in abundance. Moreover, the Buginese dealers, as they have circulated more freely through the country, have introduced hazard and cock-fighting, with the most disastrous consequences. The steamer in which Heer Tromp travelled was unable to ascend the river beyond Muvara-Pahu, but he himself advanced some distance farther in a rowing-boat. As far as Juhalang the river is easily navigable; but beyond, the current is too strong, except when the water is abnormally low, and at Kapala-kiham a series of waterfalls practically limits the navigation.

Hence the difficulty of extending Dutch rule into Upper Kutei. Indeed, communication with Sarawak along the Seliku, one of the most important affluents of the Mahakam, which rises in the Batu-Tibang opposite the sources of one of the tributaries of the Batang-Rejang, seems to be more feasible than with the Lower Mehakam. It is also possible to reach the Upper Kayan by the Boh River, which enters the Mahakam above the first fall; but it necessitates a journey of eight days on the river, and three over uneven and stony country to the highest navigable point of the Laya, a tributary of the Kayan. In the last-mentioned river an obstruction is said to exist even more formidable than the falls on the Mahakam. This remote country is inhabited by a number of Dyak tribes, which, as well as the Bahau-Dyaks of the Malakam, the Kenyas of the Upper Kayan, and others, had their home originally near the sources of Kayan. Since such insurmountable obstacles to communication exist on the routes already discussed, Heer Tromp turns his attention to the Kapuas River on the west. He passes over the lower course of the river up to Bunut with only a few cursory remarks, as it has been already described by Professor Veth in his *Borneo's Westerafdeeling.* The town of Bunut, at the mouth of a tributary of the same name, is the capital of the last Malayan kingdom.

Several affluents enter the main stream before the next town of any importance, Putus-Sibow, is reached. Here the Dyaks carry on a considerable trade with the Malay dealers, bartering the products of their forests against copper utensils, salt, tobacco, linen, crockery, etc. In 1888 Heer Tromp ascended this river, the Kapuas, in a steamer as far as the mouth of the Mendalam, a distance of 400 miles from the sea. It will be seen at once that it possesses a great advantage over the Mahakam, on which navigation is possible only for a distance of 250 miles.

Moreover, the Mendalam can be ascended by steamer, and Heer Tromp continued his journey in a boat up the Kapuas itself as far as Lunsa. Hajji Achmet, a native clerk, ascended the Bougan River, which enters the Kapuas at Lunsa, and its affluent the Bulet, to a point whence, he heard, the Seputan, a tributary of the Kaso, which flows into the Mahakam, could be reached in a day's march. This appears probable, for nowhere in this country are elevations of any great height to be seen. The Taman-Dyaks, who dwell on the Upper Kapuas, are more civilized than the Bahaus or the Kayans. Their women wear tasteful sarongs ornamented with beads and shells, and do not tattoo themselves, like the Kayan women.

[1] From the Scottish Geographical Magazine for February, 1891.

EDUCATION IN GERMANY.[1]

THE resolutions arrived at by the Conference on School Reform in Berlin may be summed up as follows : —

(1) Only two kinds of high schools are to survive, — gymnasia and non-Latin or non-classical schools (oberrealschulen and höhere bürgerschulen). A common lower school for gymnasia and non-Latin schools, so warmly advocated by many, is considered undesirable. The change from the one school to the other will be facilitated in every possible manner.

(2) The over-pressure, which is one of the most crying evils at the present time, is to be greatly reduced. A diminution of the hours devoted to Latin and Greek is considered possible, without any risk to the supremacy of classics. The Latin essay is to be abolished, as well as the Greek translation in the written examination for remove into the prima. German is to become the chief subject of instruction. Contemporary history is to be more thoroughly studied, without, however, adding to the hours assigned to history.

[1] From the London Journal of Education.

(3) Especial stress is laid on the fact that home tasks are not to be increased; that the bulk of the work should be performed in school; and that, with this object in view, an alteration in the present method of teaching is absolutely necessary.

(4) For the teacher, more thorough pedagogic education and a higher social status are insisted on.

(5) Teachers should not be specialists, but form masters, and should realize their responsibility for the physical as well as the intellectual development of their pupils. Greater attention should be paid to the health of the boys, and to the demands of hygiene in the schools.

(6) The final school examination (which serves as entrance examination to the university) should be regarded as the "remove" examination out of the oberprima, and consequently should be restricted to work done in this class. The Latin essay is henceforth to be abolished, and the examination in other respects made considerably easier.

In order to meet the probable growing demand for höhere bürgerschulen and realschulen, the conference passed a number of resolutions, the most important of which were that gymnasia or realgymnasia, where only a small proportion of the pupils pass into the upper classes, should be turned into realschulen; that in towns where there are several gymnasia or realgymnasia, if possible, one of these should be turned into a realschule. In the establishment of new schools, preference is to be given to realschulen, but at the same time the interests of the minority of the inhabitants of small towns without gymnasia are to be considered by having Latin instruction given where desired in the three lowest classes, so that pupils who are intended for a gymnasium may be prepared for it without leaving their homes at too early an age.

The salaries of the teachers in the realschulen are to be on the same scale as those in the gymnasia.

It is thought likely that the demand for realschulen will increase, now that a leaving-certificate from a realschule qualifies for all the lower government posts, and for the one year's military service. There is to be a special examination for this privilege in the gymnasia at the end of the year in the unter secunda.

Another reform is the putting of gymnasia and realschulen on an equal footing with regard to the right of study for all degrees in the university and technical high schools (these are of the nature of technico-scientific universities). The only condition for realschule students is the completion of their leaving-certificate by certificates of their proficiency in classics, while gymnasium students must obtain certificates of proficiency in drawing and mathematics. Moreover, the school authorities have the right to excuse good pupils from the gymnasium or realschule this supplementary examination; also every candidate who has passed the final examination of a nine-class high-school shall be admitted to all state examinations, if, during his term of study, he passes the necessary special examination which he has omitted during his school career. It is these reforms which are really the most important, for they make it possible to carry out the proposed changes without injuring the interests of many classes.

The committee for the carrying-out of the reforms resolved upon in the conference held its first meeting in Berlin on Jan. 6. The committee consists of Geheimrath Hinzpeter as chairman; Dr. Schrador, curator of the Halle University, as vice-chairman; Dr. Fiedler of Breslau; Dr. Graf of Elberfeld; Dr. Kropatscheck of Berlin; Dr. Schlee, director of the Realgymnasium of Altona; and Dr. Uhlhorn of Hannover. The members of the Council for Education are not on the reform committee, but several of them are appointed to draw up the report. The committee agreed as to the reforms necessary for raising the social standing of the teacher, and on the conditions for the right to one year's military service. The next general meeting is to be held in February, and meanwhile the work of reform is to be furthered by private consultations.

Reforms have already been initiated in Würtemburg gymnasia. They are divided into ten classes, of which Class I. is the lowest. The chief alteration is that Latin is to be begun in Class II. instead of Class I., in which the average age is eight. In the lowest class the time is to be spent in mastering reading, writing, and the elements of arithmetic; also Greek is to be begun in the fifth instead of the fourth, the average age of which is eleven. Then the time devoted to classics is to be curtailed in all classes, so that from the second to the sixth not more than ten hours, from the seventh to the tenth not more than eight hours, are given to classics in the week. This means a reduction from 102 hours to 82 hours in all the classes reckoned together. The number of school-hours is not to be diminished, but the time saved is to be given to other subjects. German is to have 28 hours as against 26, French 18 instead of 16, mathematics 39 instead of 37, physiography 16 instead of 10, and obligatory drawing in Classes IV. to VI. 7 hours, whereas before no time was devoted to this subject.

The chief feature of the reform programme is the emphasis laid on making grammar the handmaid of literature, on mastering the text, and gaining a knowledge of grammar by study of it rather than making grammar an aim in itself. The official publications point out the fact that these alterations are comparatively insignificant, and that the Würtemberg educational authorities consider the time not yet ripe for extensive reforms, more especially as the resolutions passed by the Berlin School Conference really tend to make the gymnasia of Prussia more nearly resemble those of Würtemburg. For instance: the gymnasium in Würtemberg has no Latin essay, and the division of secondary schools into gymnasia and non-classical realschulen is already carried out.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Discovery of Fish-Remains in Lower Silurian Rocks.

AT a meeting of the Biological Society of Washington on Feb. 7, 1891, Mr. Charles D. Walcott of the United States Geological Survey announced the discovery of vertebrate life in the Lower Silurian (Ordovician) strata. He stated that "the remains were found in a sandstone resting on the pre-paleozoic rocks of the eastern front of the Rocky Mountains, near Cañon City, Col. They consist of an immense number of separate plates of placoganoid fishes and many fragments of the calcified covering of the notochord, of a form provisionally referred to the *Elasmobranchii*. The accompanying invertebrate fauna has the facies of the Trenton fauna of New York and the Mississippi valley. It extends upward into the superjacent limestone and at an horizon 180 feet above the fish-beds. Seventeen out of thirty-three species that have been distinguished are identical with species occurring in the Trenton limestone of Wisconsin and New York.

"Great interest centres about this discovery from the fact that we now have some of the ancestors of the great group of placoderm fishes which appear so suddenly at the close of the Upper Silurian and in the lower portion of the Devonian groups. It also carries the vertebrate fauna far back into the Silurian, and indicates that the differentiation between the invertebrate and vertebrate types probably occurred in Cambrian time."

Mr. Walcott is preparing a full description of the stratigraphic section, mode of occurrence, and character of the invertebrate and vertebrate faunas, for presentation at the meeting of the Geological Society of America in August, 1891. L. A.

Washington, Feb. 10.

Was Lake Iroquois an Arm of the Sea?

IN *Science* recently Professor Davis stated several reasons leading to the belief that the Iroquois beach was formed by a lake instead of being formed by the sea, as held by Professor Spencer. It is possible that both theories are partly right, and that there was once a lake overflowing the divide at Rome, while later the basin of Lake Ontario or its eastern portion was occupied by the sea. It is not my present purpose to enter into a general discussion of the question, but to call attention to a class of deposits

which appear not to have heretofore been described in connection with this question.

For instance: in the town of Schroeppel, Oswego County, N.Y., and extending across the Oneida River (outlet of Oneida Lake) for several miles into Clay, Onondaga County, there is a plain of much rolled and rounded bowlderets, cobbles, pebbles, gravel, and sand. Many of the stones, especially the larger ones, are composed of crystalline rocks from Canada. In the midst of the plain are numerous depressions, some of them containing one hundred acres or more. The deeper depressions are occupied by lakes without visible outlets, usually bordered by steep banks of sand or gravel up to seventy-five feet high. The smaller hollows present the well-known phenomenon of kettle-holes surrounded by reticulated kames, some of which are shown by excavations to have an anticlinal stratification. The coarser material is more abundant toward the north, and the sediments become finer in composition as we go south and south-eastward. At the same time the hollows become shallower, and the deposit expands somewhat in fan shape. Many of the shallower hollows contain swamps, once ponds, now peated over or filled with humus and silt often containing fresh-water shells. The plains of sand and gravel are bordered by broad plains of clay or silt. Some of the clays contain fresh-water shells; but my observations were made some years ago, and are not detailed enough to determine whether any of the fossiliferous clays are contemporaneous with the sand and gravel plains. Some of them are plainly later.

In Maine I have had opportunity to study scores of the deltas dropped by glacial rivers near where they entered the sea at a time it stood above its present level. They present the same proofs of a gradual stopping of the currents as are shown in the plain above described. The coarser fragments were first dropped as the rivers entered still water, and the assortment proceeded as their rate became slower, until at last the finest clay and rock-flour settled on the bottom of the water. The plain at the Oneida River has substantially the same structure as the deposits which I have described in Maine as deltas of glacial sediments: I therefore regard the plain as having been deposited by glacial rivers in still water in front of the ice, but not far from the ice-front. The assortment is more systematic, and takes place within less distance than is found in the frontal plain deposited in front of the ice on land sloping away from the glacier. This I regard as proof that the slopes of the land at that place were northward in glacial time, as they are at present. According to this interpretation, certain conclusions follow: 1. At a certain time the central part of the basin of Lake Ontario was still occupied by land-ice, which extended south to near the present Oneida River; 2. At this time south of the ice-front there was a body of open water, which at this place was fifteen or more miles wide; 3. The broad and deep sheets of gravel, sand, and clay which now cover the site of this open water are composed chiefly of the sediments of glacial rivers pouring from the north into still water, and dropping their burden.

If it be claimed that these sediments represent a sheet of glacial till which was eroded by the waves and re-deposited as aqueous sediment, then the material should grow finer as we go northward away from the Iroquois beach, whereas at the Oneida River we have the opposite arrangement. If it be claimed that these sediments were the result of wave-erosion of the solid rock, we have a right to demand that the system of beach-cliffs adequate to furnish so great a mass shall be pointed out to us. There are hundreds of square miles covered with sediments which in many places are known to be eighty or a hundred feet thick. The small amount of wave-erosion required to form the beach is in remarkable contrast with the scarp of erosion required by this theory. Moreover, any erosion hypothesis must assume a much greater erosion of the till than even the Atlantic was able to accomplish on the coast of Maine during its elevation in late glacial and post-glacial time. And if we suppose this drift to have its origin in any form of floating ice, how shall we account for the deep kettle-holes and reticulated ridges, or for the attrition which rounded the cobbles and bowlderets in tracts extending at right angles to the beach, or for the horizontal assortment of the sediments, they growing finer as we go south? I see no admissible theory except that above stated.

It would appear that any hypothesis of the marine origin of the Iroquois beach must concede that the central part of the basin of Lake Ontario was still covered by land-ice at the time when a body of water ten to thirty miles broad lay to the south of the ice-front. Into this body of water great glacial rivers flowed, so that it was practically a body of fresh water, even if at sea-level.

In addition to the delta plain above described, there are in the region other deposits that are probably glacial sediments, but I have not examined the country lying east of the plain in question so systematically as to be certain. If a line of frontal deltas can be traced eastward and westward, it will enable us to map the ice-front of that period. The relation of such a series to the Iroquois beach, especially in the country situated north and north-east of Watertown, would greatly help to decide the question whether the body of water that lay south of the ice was a lake or an arm of the sea. G. H. Stone.

Colorado Springs, Col., Feb. 5.

Rain-Formation.

In your issue of Feb. 6 Professor Hazen has produced a table whereby it is intended to show that "on an average more than half the rain at Pike's Peak occurs with a falling temperature;" and from subsequent remarks in his letter it appears that the professor hereby means to say that the surface air grew gradually colder while this rain was falling, at which, to him, extraordinary result he expresses his surprise.

To an ordinary individual it may not seem surprising if rainfall should have the effect of lowering the temperature of the surface-air, when it is considered that the raindrops descend from colder upper regions, and in all probability generally first appear as snow-flakes, and also, though not so much, that the clouds prevent the sun from keeping up the temperature of the surface-air; but I shall allow myself to point out that whether the downpour has the effect of changing the temperature of the surface-air or not, cannot possibly be ascertained from observations at Pike's Peak or any other isolated station.

Let us take the case before us of rain having fallen at Pike's Peak for ten hours with a falling thermometer, and that the wind was blowing during that time at a rate of about twenty miles an hour. The surface-air which during the ten hours passes the station at Pike's Peak will then represent a body of air two hundred miles long; and when the rain set in it may have been located on lower land. The eleven readings of the thermometer give us, therefore, the temperature of air-bodies located at distances of twenty miles from one another, and taken, not all at the same moment, but at eleven different hours; and I should feel obliged to Professor Hazen if he would explain how it is possible to deduce from these readings whether the surface-air as such grew colder or warmer during the fall of rain.

It is probably from drawing inferences of this nature that the professor arrives at such apparent anomalies as when he makes the following amazing statement: "While it might be thought that a falling temperature in a saturated air would tend to produce rainfall, such is by no means the fact. There are many cases in which a fall of from ten to fifteen degrees of Fahrenheit has occurred in saturated air without any corresponding rainfall." Here is really no anomaly. The air which passed the place of observation was all saturated, and the air which came first had a temperature ten to fifteen degrees higher than the temperature of the air which afterwards passed by; but Professor Hazen infers that it was the same air he was examining all the time, and consequently wonders why it wouldn't rain when saturated air "got chilled." Franz A. Velschow, C.E.

Brooklyn, N.Y., Feb. 13.

BOOK-REVIEWS.

Social Diseases and Worse Remedies. By T. H. Huxley. New York, Macmillan. 16°. 30 cents.

This pamphlet contains a series of letters published a few weeks since in the London *Times*, criticising quite severely the scheme for relieving poverty devised by Mr. Booth, the "general" of the Salvation Army. In his first letter Mr. Huxley condemned the

scheme, partly because of its socialistic character, but mainly because in his opinion the Salvation Army was liable to degenerate into "a mere engine of fanatical intolerance and personal ambition." The publication of this letter, however, brought him a large amount of new information, some of it coming from persons that had been officers of the Salvation Army, and all tending to show that his apprehensions were amply justified. It appears that the officers are all under obligation, like the Jesuits, to "'obey, without questioning or gainsaying, the orders from headquarters;'" and it further appears from evidence that has not been questioned that large sums of money and other property originally contributed by the public have been "handed over to Mr. Booth and his heirs and assigns." This property is ostensibly held in trust, but Mr. Huxley shows that there is no legal obligation to that effect. He also criticises some of Mr. Booth's social theories, remarking that "with thrift and self-respect denounced as sin, with the suffering of starving men referred to the sins of the capitalist, the Gospel according to Mr. Booth may save souls, but it will hardly save society."

The result is, that Mr. Booth's schemes are unqualifiedly condemned, while at the same time the author of the letters shows that he realizes the misery of the poor, and the danger it threatens to society, as fully as any one. Indeed, he seems to us to exaggerate the social danger, remarking that "unless this remediable misery is effectually dealt with, the hordes of vice and pauperism will destroy modern civilization as effectually as uncivilized tribes of another kind destroyed the great social organization which preceded ours." He also reprints an essay published in a magazine in 1888, in which he takes a very pessimistic view of the problem of poverty; but the only remedy he proposes is technical education, which to our mind is altogether inadequate. The whole pamphlet, however, is very interesting, and should be read by every one who is concerned for the welfare of the laboring poor.

AMONG THE PUBLISHERS.

THE American Academy of Political and Social Science will shortly issue a translation of Professor Meitzen's work on statistics. English literature on this subject is so meagre, that every one interested either in its theoretical or practical aspects will be glad to learn of this accession to our stock of scientific material. Dr. R. P. Falkner of the University of Pennsylvania has made the translation.

— "Therapeutic Sarcognomy: a New Science of Soul, Brain, and Body," is the title of a forthcoming work from the house of the J. G. Cupples Company, Boston. The author is Professor J. R. Buchanan.

— In the *Illustrated American* for the week ending Feb. 21 there are illustrations of some of the treasures, in the way of old books and bric-a-brac, that are contained in the collection of Mr. Brayton Ives, about to be sold.

— "Liberty in Literature" is the title of a small volume, well printed and neatly bound, recently published by the Truth-Seeker Company of this city. It is an address delivered by Robert G. Ingersoll at Horticultural Hall, Philadelphia, on Oct. 21, 1890, on the occasion of a testimonial to Walt Whitman. A portrait of the aged "good gray poet" illustrates the volume.

— N. D. C. Hodges, 47 Lafayette Place, New York, has now in press a work by Dr. Daniel G. Brinton, entitled "The American Race: a Linguistic Classification and Ethnographic Description of the Native Tribes of North and South America." It is the first attempt ever made to classify all the Indian tribes by their languages, and it also treats of their customs, religions, physical traits, arts, antiquities, and traditions. The work comprises the results of several years of study in this special field.

— Professor Morey of Rochester University, the author of "Roman Law," has submitted a paper to the American Academy of Political and Social Science on "The Genesis of our Written Constitutions," which will shortly be issued by that body. He attempts to show, that, so far from Mr. Gladstone's famous words relating to the origin of the Constitution of the United States being true, that instrument was a legitimate development of the Constitution of the Colonies then existing, which in their turn had grown out of the charters of the old trading-companies.

— "The Harpur Euclid," just published by Rivington of London, and Longmans, Green, & Co., of New York, is an edition of Euclid's "Elements" revised in accordance with the reports of the Cambridge Board of Mathematical Studies and the Oxford Board of the Faculty of Natural Science. It is the joint production of Edward M. Langley, M.A., and W. Seys Phillips, M.A. The work is intended to be strictly a school edition of Euclid. While retaining his sequence of propositions, and basing their proofs entirely on his axioms, the editors have not scrupled to replace some of his demonstrations by easier ones, and to discard whatever they considered superfluous or unnecessary. A good feature of the miscellaneous exercises given in the volume is that they are taken from widely different sources; some being original, others taken from examination-papers, and still others being well-known theorems or problems given by most writers on the same subject.

— The late work of Henry M. Howe (son of Julia Ward Howe) on "The Metallurgy of Steel" has met with pronounced success. It has been warmly commended by many of the scientific journals of Europe. We quote some of their opinions: "This work promises to become a classic. With a lucid style it combines thorough comprehension of the subject and a wise conciseness," says the *Colliery Guardian*, London. Other authoritative opinions are as follows: "It is not only the most beautiful book ever published about steel, but certainly, also, the most complete and profound" (*Revue Universelle des Mines*, Liege, Belgium). "We fully indorse and recommend it to the German metallurgists as one of the most important contributions in modern times to the siderometallurgial science" (*Berg-und Huettenmaennische Zeitung*, Berlin, Germany). "This stately quarto is the most exhaustive yet written on the subject" (Professor Ledebar, Freiberg, Germany). "It is so easily and so far in advance of any thing that has ever been published on iron, that it marks an epoch in the literature of the subject" (Professor Drown, Institute of Technology, Boston).

— In the *Atlantic* for March, in an autobiographic fragment entitled "My Schooling," we are told of James Freeman Clarke's early educational training. "The State University in America," by George E. Howard, advocates the establishment of universities in each State, which shall be universities in something more than name, and the relegation of the many colleges of insufficient means to a grade intermediate between the school and the university. A paper on "The Speaker as Premier," by Albert Bushnell Hart, is a timely consideration of a question which has been much before the public of late. Mr. Lowell continues his articles on travel in Japan. Perhaps the most valuable contribution to the number is Francis Parkman's first paper on the "Capture of Louisbourg by the New England Militia," an historical study of much importance, and with an incidental sketch of the Wentworth House, at New Castle, Maine, which is very charming. Miss Agnes Repplier, in an amusing and thoughtful paper called "Pleasure: A Heresy," appeals. not for more cultivation in life, but for a recognized habit of enjoyment. The article is full of good-natured banter at the expense of the self-consciously cultivated persons, who demand from both literature and art, not pleasure, but some serious moral purpose.

— Mark Brickell Kerr, topographer of the National Geographic Society's expedition to Mount St. Elias in the summer of 1890, will describe the adventures and discoveries of that exploration in the March *Scribner*. The results of his study of glaciers are especially valuable, as well as the determination of a new measurement for the altitude of this famous Alaskan mountain. Samuel Parsons, jun., superintendent of parks for New York City, who has done so much to beautify the public fountains with rare water-lilies, papyrus, and lotus, will describe the practical means of ornamenting ponds and lakes in the same number. This article will especially interest people with small places in the country, having natural streams and ponds upon them.

— In *The Chautauquan* for March, 1891, we note the following contributions: "The Intellectual Development of the English

People," by Edward A. Freeman; "England after the Norman Conquest," Part III., by Sarah Orne Jewett; "The English Towns," III., by Augustus I. Jessopp, D.D.; "The United States of the Pacific," by Fred. Perry Powers; "Coxcomb and Coquette in Tudor Times," by James A. Harrison, LL.D.; "Social Reform and the Socialists," by Robert Ellis Thompson, D.D.; "Studies in Astronomy," VI., by Garrett P. Serviss; "Singapore," by Rev. W. F. Oldham, D.D.; "Dr. Koch and Consumption," by J. P. Hassler, M.D.; "Politics and Politicians," by Judge Frederick G. Gedney; "The Story of the Opium Curse in India," by Bishop John F. Hurst, LL.D.; "The Woman's World of London," by Elizabeth Robbins Pennell; "How Marriage affects a Woman's Property," by Lelia Robinson Sawtelle, LL.B.; and "To What Kingdom does Woman belong?" by Kate C. Bushnell, M.D.

— C. W. Bardeen of Syracuse sends us a small pamphlet entitled "Tiedemann's Record of Infant Life." It is from the French translation of a German work, with a commentary interwoven by M. Michelan, the English version being by Bernard Perez. The original author, who lived about a century ago, records in this work his observations of his own son in the first two years of his life, noting down many points that will be interesting to those who are engaged in similar researches. The phenomena of child-life, as thus recorded by him, differ in many respects from those noticed by Darwin and other recent observers,— a fact which shows that caution is necessary in generalizing from such observations; but we cannot enter into particulars here. Mr. Bardeen also sends us three papers read before the National Educational Association at St. Paul in July last. One is by himself, on the "Effect of the College Preparatory High School upon Attendance and Scholarship in the Lower Grades," in which he takes the ground that the maintenance of a classical course in the public high schools helps to raise the whole tone of the school, and is therefore useful even to those who take the English course. He does not quite make clear, however, how the requisite classical scholarship can be secured without beginning the course before the usual age for entering the high school. Another of the papers is by W. H. Maxwell, on "Examinations as Tests for Promotion," in which he repeats the well-worn arguments in favor of examinations, but without offering any thing new, and showing, as it seems to us, an insufficient sense of the abuses to which examinations are apt to lead. Mr. Henry Sabin, State superintendent of Iowa, treats of "Organization and System vs. Originality and Individuality," taking strong ground against the mechanical system of teaching and school organization now so much in vogue as injurious to both teacher and pupil. All the papers have merit; but we cannot help thinking that the authors might have done better if they had taken a little more pains.

— J. B. Lippincott Company announce as in press "The Design of Structures: A Practical Treatise on the Building of Bridges,

Publications received at Editor's Office, Feb. 9-14.

Agricultural Experiment Station. Ithaca, N. Y. Third Annual Report of the, 1890. Ithaca, Cornell Univ. 187 p. 8°.
Electric Railways and Systems in Operation, Maps of the United States, showing the Central Station Plants and. Boston, Thomson-Houston Electric Co. 110 p. f°.
Harvard College, Annals of the Astronomical Observatory of. Vol. XXVII. The Draper Catalogue of Stellar Spectra photographed with the 8-inch Bache Telescope as a Part of the Henry Draper Memorial. Cambridge, John Wilson & Son. 388 p. 4°.
Hiorns, A. H. Mixed Metals or Metallic Alloys. London and New York, Macmillan. 384 p. 16°. $1.50.
Huxley, T. H. Social Diseases and Worse Remedies. London and New York, Macmillan. 128 p. 16°. 30 cents.
Pickering, E. C. Forty-fifth Annual Report of the Director of the Astronomical Observatory of Harvard College for the Year ending Oct. 31, 1890. Cambridge, Harvard Univ. 12 p. 8°.
Pickering, E. C., and Wendell, O. C. Annals of the Astronomical Observatory of Harvard College. Vol. XXIII. Part I. Discussion of Observations made with the Meridian Photometer during the Years 1882-88. Cambridge, John Wilson & Son. 136 p. 4°.

Roofs, etc.," by S. Anglin; "An Introduction to the Study of Metallurgy," by C. Roberts Austen, C.B., F.R.S.; "Chambers's Encyclopædia," Vol. VII. (entirely new edition, revised and re-written); "The Old Navy and the New," by Rear-Admiral Daniel Ammen, U.S.N.; "Tables for the Determination of Minerals," by Persifor Frazer, jun., A.M. (new edition, revised and enlarged); "Aids in Practical Geology," by G. A. J. Cole, F.G.S.; "Historic Note-Book," by the Rev. E. Cobham Brewer, LL.D., Trinity College, Cambridge; and "Regional Anatomy in its Relation to Medicine and Surgery," by George McClellan, M.D. (illustrated from photographs taken by the author of his own dissections, expressly designed and prepared for this work, and colored by him after nature).

—The next number of the "Publications of the American Academy of Political and Social Science" will consist of an address on "Municipal Government and Public Health," by the eminent editor of the *Index Medicus*, Dr. John S. Billings, of the United States Army. The author sets forth in a clear way the proper municipal organization of health. Every city councilman in the country, as well as every other citizen interested in this important subject, should read this paper.

—"Central Station Electric Lighting Plants and Electric Railways of the United States" is the title of a novelty in book-making just published by the Thomson-Houston Electric Company of Boston. It is a cloth-bound folio atlas of 110 pages, showing, on maps of the different States and Territories, the location of every city or town in the United States having central-station electric-lighting plants or electric railways. By means of a set of symbols, aided by colors, the particular system in use in each place is shown graphically. The maps are, of course, mere outlines, showing only the locations within the scope of the work, and the system or systems in use at each place. The volume should prove of permanent practical value to all interested in the subject, as by means of pen or pencil it may easily be kept up with the times.

SCIENCE

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CALENDAR OF SOCIETIES.

New York Academy of Sciences.

Feb. 23.—J. A. Allen, Recent Work in North American Mammalogy.

Election of Officers.—President, John S. Newberry; first vice-president, Oliver P. Hubbard; second vice-president, J. A. Allen; corresponding secretary, Thomas L. Casey; recording secretary, H. Carrington Bolton; treasurer, Henry Dudley; librarian, John I. Northrop; councillors, N. L. Britton, Charles F. Cox, A. A. Julien, D. S. Martin, J. K. Rees, J. J. Stevenson; curators, George F. Kunz, John I. Northrop, N. L. Britton, D. S. Martin, H. T. Vulte; and finance committee, John H. Hinton, H. G. Marquand, and O. B. Potter.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head **FREE OF COST,** ***if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.***

WANTED—A position to teach Electrical Engineering by a student from leading English and French and U. S. science schools, or would accept position as Consulting Electrical Engineer, Electrician, etc. Very highest testimonials. London & Hartford Publishing Co., N. Y. (International Press Department.)

WANTED.—A young man in college would like a position during the summer of 1891 in some scientific work, particularly Orinthology, either as an instructor or tutor, or in making collections or accompanying some scientific expedition. Can give good references. Address HUBERT L. CLARK, Amherst, Mass.

WANTED.—A young man who has been teaching in a first-class High School desires a position in a similar institution. Is competent to teach Mathematics, Latin, Book-keeping, and the English branches. Can give highest references Address H. W. MARTHENS, 6208 Broad St., Pittsburgh, Pa.

WANTED.—A situation in a scientific house by a graduate of the scientific department of the Jersey City High School as Geologist, Mineralogist or as assistant teacher in Physics or assistant to a chemist. Best of references. E. W. PERRY, 582 Third Street, Jersey City, N. J.

WANTED.—By a medical student of three courses, a position on some war or mercantile vessel sailing between America and some foreign country, as Clerk, Assistant Physician or Druggist, or any respectable occupation. Content with a moderate remuneration. Highest commendations. W. L. S., *Science* Office.

INFORMATION WANTED.—Clarence W. Bowen, Secretary of the Committee on the Centennial of Washington's Inauguration, 251 Broadway, New York, desires information regarding the portraits of John Hathorn and Jeremiah Van Rensselaer, members of Congress from New York. These portraits, for the Memorial Volume, are particularly desired, to complete the list of portraits of the New York delegation in Congress at the time of Washington's inauguration.

WANTED.—One first-class instrument-maker. Apply by letter to T. C. MENDENHALL, Superintendent U. S. Coast and Geodetic Survey, Washington, D. C

WANTED.—An Entomologist to accompany a camping party of boys during July next. Address, stating experience and salary expected. ALBERT L. AREY, Free Academy, Rochester, N.Y.

WANTED.—A young man wishes a position in an experiment station, botanical department preferred. References and evidence of competency on application. Address E. E. BOGUE. Agr. Experiment Station, Columbus, O.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

Will exchange a new Thomson reflecting astatic galvanometer, about 6,000 ohms, made by Clark, Muirhead & Co, London, and costing £30, with 1-9, 1-99, 1-999, shunts, lamp and scale, for a Weston voltmeter and ammeter, or large Wheatstone bridge, dial pattern, or a portable testing outfit. Address G. A., *Science* Office, 47 Lafayette Place, New York.

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

I have a good supply of Eastern Coleoptera which I wish to exchange for species not in my collection. Melandryidae and Oedemeridae especially desired. Joe C. Thompson, Rosebank P. O., Box 73, S. I.

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1890 Seeger and Guernsey Cyclopedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost $6. David R. Lewis, Saybrook, Ill.

SCIENCE

NEW YORK, FEBRUARY 27, 1891.

SUGGESTION IN INFANCY.[1]

THE rise of hypnotism in late years has opened the way to an entirely new method of mental study. The doctrine of pure reflexes was before largely physiological, and only pathological cases could be cited in evidence of a mechanism in certain forms of consciousness as well as out of it; and even pathological cases of extreme sensitiveness to casual suggestion from the environment or from other men did not receive the interpretation which the phenomena of hypnotic suggestion are now making possible, i.e., that suggestion by idea, or through consciousness, must be recognized as as fundamental a kind of motor stimulus as the direct excitation of a sense-organ: in other words, *that nervous reflexes work directly through states of consciousness; that the latter are integral portions of these reflexes;* and, further, *that a large part of our mental life is made up of a mass of such ideo-motor reflexes, which are normally in a state of subconscious inhibition.*

Without discussing the nature of the hypnotic state, nor venturing to pass judgment in this connection upon the question whether the suggestion theory is sufficient to explain all the facts, we may yet isolate the aspect spoken of above, and discuss its general bearings. Of course, the question at once occurs, is the normal life a life to any degree of ideo-motor or suggestive re-actions, or is the hypnotic sleep in this aspect of it quite an artificial thing? Further, if such suggestion is normal or typical in the mental life, what is the nature of the inhibition by which it is kept under? Leaving this second question altogether unanswered for the present, it has occurred to me to observe my child[2] during her first year to see if light could be thrown upon the first inquiry above. If it be true that ideo-motor suggestion is a normal thing, then early child-life should present the most striking analogies to the hypnotic state in this essential respect. This is a field that has hitherto, as far as I know, been almost untouched by psychologists.

Observation of re-actions clearly due to suggestion in my child, either under natural conditions or by experiment, lead me to distinguish the following kinds of suggestion, mentioned in the order of their appearance in child-life: —

Suggestion
- Physiological
- Sensori-motor
- Ideo-motor
  - Deliberative
  - Imitative

I shall proceed by first describing the class of phenomena designated, and then the evidence, small or great, which my observations afford in each case.

1. *Physiological Suggestion.* — By "suggestion" ordinarily is understood ideal or ideo-motor suggestion, — the origination from without of a motor re-action by producing in consciousness the state which is ordinarily antecedent to that re-action. But observation of an infant for the first month or six weeks of its life leads to the conviction that its life is mainly physiological. The vacancy of consciousness as regards any thing not immediately given as sensation, principally pleasure and pain, precludes the possibility of ideal suggestion as such. The infant at this age has no ideas in the sense of distinct memory-images. Conscious states are affective. Accordingly, when the re-actions which are purely reflex, and certain random impulsive movements, are excluded, we seem to exhaust the contents of consciousness.

Yet even at this remarkably early stage H. was found to be in a degree receptive of suggestion — suggestion conveyed by repeated stimulation under uniform conditions. In the first place, the suggestions of sleep began to tell upon her before the end of the second month. Her nurse put her to sleep by laying her face-down and patting gently upon the end of her spine. This position soon became itself not only suggestive to the child of sleep, but sometimes necessary to sleep, even when she was laid across the nurse's lap in what seemed to be an uncomfortable position.

This illustrates what I mean by physiological suggestion. It is the law of physiological habit as it borders on the conscious. No doubt some such effect would be produced by pure habit apart from consciousness; but, consciousness being present, its nascent indefinite states may be supposed to have a quality of suggestiveness, which indicates the degree of fixedness of the habit. Yet the fact of such a coloring of consciousness in connection with the growth of physiological habit is important more as a transition to more evident suggestion.

The same kind of phenomena appear also in adult life. Positions given to the limbs of a sleeper lead to movements ordinarily associated with these positions. The sleeper defends himself, withdraws himself from cold, etc. All secondary automatic re-actions may be classed here, the sensations coming from one re-action (in, say, walking) being suggestions to the next movement unconsciously acted upon. The state of consciousness at any stage, if present at all, must be similar to the baby's in the case above, — a mere internal glimmering, whose reproduction, however brought about, re-enforces its appropriate re-action.

The most we can say of such physiological suggestion is, that, when the conscious state is present, the re-action is subsequently abbreviated and facilitated; but whether abbreviation is due entirely to habit, and the consciousness is only a result of such abbreviation, not its cause, we are unable to say.

The physiological process involved, and its relation to consciousness, may be brought out by a diagram; but, in order that it and those which follow may be easily understood, it may be well to present the *motor square*, as we

[1] For the general facts and interesting treatment of the movements of infants, see Preyer's Senses and Will, part ii.

[2] Called hereafter simply H.

may call it (Fig. 1), which contains all the elements of the phenomena of suggestion, and of which the special diagrams below are modifications.

Each corner indicates a physiological process with or without consciousness, as follows: *sg* = suggestion (sensory); *mp* = seat of motor process; *mt* = movement of muscle; *mc* = consciousness of movement. The sides of the square are connections between the seats of these processes. A cross (×) in any corner indicates that the brain process alone is intended at that seat; a circle (O), that consciousness at that seat is intended.

The stimulus *sg* (Fig. 2) starts the motor process *mp:* it leads to movement, *mt*, which is reported to consciousness,

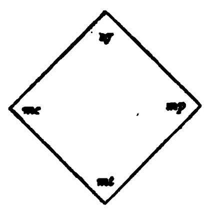

FIG. 1.—MOTOR SQUARE.

mc. The line between *sg* and *mc* is broken, because at this stage in infancy associations are just beginning to be formed between a feeling of muscular movement and its stimulating sensation.

2. *Sensori-Motor Suggestion.*—These cases of suggestion may be classed somewhat in this way:—

(*a*) *Various Sleep Suggestions.*—From the first month on, there was a deepening of the hold upon her of the early method of inducing sleep. The nurse, in the mean time, added two nursery rhymes. Thus position, pats, and rhyme sounds were the suggesting stimuli. Not until the third month, however, was there any difference noticed, when the same suggestions came from other persons. I myself learned, during the fourth month, to put her to sleep, and

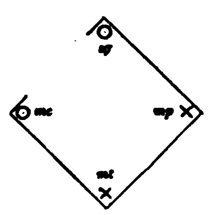

FIG. 2.—PHYSIOLOGICAL SUGGESTION.

learned with great difficulty, though pursuing the nurse's method as nearly as possible. Here, therefore, was a sleep suggestion from the *personality* of the nurse,—her peculiar voice, touch, etc. At this time I assumed exclusive charge of putting H. to sleep in order to observe the phenomena more closely. For a month or six weeks I made regular improvement, reducing the time required from three-quarters of an hour to half an hour, finding it easier at night than at mid-day. This indicated that darkness had already become an additional sleep suggestion, probably because it shut out the whole class of sensations from sight, thus reducing the attention to stimuli which were monotonous. I found by accident, in this connection, the remarkable fact that a single flash of bright light would often put H. immediately to sleep when all other processes were futile. In her fifth month I despaired one evening, after nearly an hour's vain effort, and lighted the gas at a brilliant flash unintentionally. She closed her eyes by the usual reflex, and did not open them again, sleeping soundly and long. I afterwards resorted to this method on several occasions, carefully shielding her eyes from the direct light-rays, and it generally, but not always, succeeded. I would like to know if this experience is shared by nurses or other parents. In the following month (sixth) I reduced the time required (day or night) to about a quarter of an hour, on an average. In this way I found it possible to send her off to sleep at any hour of the night that she might wake and cry out.

I then determined to omit the patting and endeavor to bring on sleep by singing only. The time was at first lengthened, then greatly shortened. I now found it possible (sixth to seventh month) to put her to sleep, when she waked in the dark, by a simple refrain repeated monotonously two or three times. In the mean time she was developing active attention, and resisted all endeavors of her nurse and mother (who had been separated from her through illness) very stubbornly for hours, while she would go to sleep for myself, even when most restless, in from fifteen to thirty minutes. This result required sometimes firm holding-down of the infant and a determined expression of countenance.

At the end of the year, this treatment being regular, she would voluntarily throw herself in the old position at a single word from me, and go to sleep, if patted alone uniformly, in from four to ten minutes. This continues to the present (sixteenth month); even when she is so restless that her nurse is unable to keep her from gaining her feet, and when she screams if forced by her to lie down. The sight only of myself makes her entirely quiet; and in, say, five minutes, rarely more, she is sound asleep. I found it of service, when she was teething and in pain, to be able thus to give her quiet, healthful sleep.

This illustrates, I think, as conclusively as could be desired, the passage of purely physiological over into sensory suggestion; and this is all that I care, in this connection, to emphasize. The explanation, as I believe, throws light upon the theory of the rise of volition; but that aspect of it may be left for future discussion.

(*b*) *Food and Clothing Suggestion.*—H. gave unmistakable signs of response to the sight of her food-bottle as early, at least, as the fourth month, probably a fortnight earlier. The re-actions were a kind of general movement toward the bottle, especially with the hands, a brightening of the face, and crowing sounds. It is curious that the rubber on the bottle seemed to be the point of identification, the bottle being generally not responded to when the rubber was removed. The sight of the bottle, also, was suggestive much earlier than the touch of it with her hands.

She began to show a vague sense of the use of her articles of clothing about the fifth month, responding at the proper time, when being clothed, by ducking her head, extending her hand or withdrawing it. About this time she also showed signs of joy at the appearance of her mittens, hood, and cloak, before going out.

(*c*) *Suggestions of Personality.*—It was a poet, no doubt, who first informed us that the infant inherits a peculiar sensibility for its mother's face,—a readiness to answer it

with a smile. This is all poetic fancy. When the child does begin to show partialify for mother or nurse, it is because the kind treatment it has already experienced in connection with the face has already brought out the same smile before; the mother's face, that is, grows to suggest the smile. At first it is not the face alone, but the personality, the *presence*, to which the child responds; and of more special suggestion, the voice is first effectual, then touch (as in sleep above), and then sight. Such suggestions are among the most important of infancy, serving as important elements in the growth of the consciousness of self and of external reality; but such considerations are not pertinent to the present connection. Without delaying longer on this class of suggestions, the question occurs, are we not here simply observing cases of the association of ideas? I think we are warranted in answering, "No!" most emphatically, for the reason that it is not an associated idea that is brought up. It is a muscular movement that is produced, without the production of an idea of that movement. Can we say that the sleep suggestions first bring up an idea or image of the sleep condition, or that the bottle brings up an idea of the movements of grasping, or even of the sweet taste? No, the case is more direct. The energy of stimulation passes over into the motor re-action through the medium of the

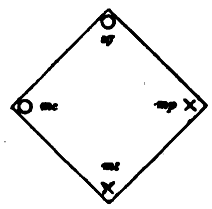

FIG. 3.—SENSORY-MOTOR SUGGESTION.

conscious state. Further, as will appear clearer below, it is not an association plus a suggestion, or an association plus an association, as current doctrines of motor-stimulation would lead us to expect. We cannot say that pleasure or pain always intervenes between the present state of consciousness and the motor re-action; i.e., mother's face, pleasure recalled, expression of pleasure, or present bottle, sweet taste, movements to reach. I believe all this is quite artificial and unnatural,— a point to which the remainder of this paper will put in clear relief.

The explanation is as before for physiological suggestion, except that the re-action begins with a conscious process (O) at *sg* (Fig. 3), and the child is getting associations between *sg* and *mc*.

3. *Deliberative Suggestion.* — By "deliberative suggestion" I mean a state of mind in which such co-ordinate stimuli meet, affront, oppose, further, one another. Yet I do not mean "deliberation" in the full-blown volitional sense; but *suggestion* that appears deliberative, while still inside the re-active consciousness. It lacks self-consciousness, self-decision, self in any form. The last three months of the child's (H.'s) first year are, I think, clearly given over to this kind of consciousness. Motor stimulations have multiplied, the emotional life is budding forth in a variety of promising traits, the material of conscious character is present; but the "ribs" of mental structure may still be seen through, re-active couples, response answering to appeal in a complex but yet mechanical way.

As an illustration of what I mean, I may record the following case of deliberative suggestion from H.'s thirteenth month: it was more instructive to me than whole books would be on the theory of the conflict of impulses. When about eight months old, H. formed a peculiar habit of suddenly scratching the face of her nurse or mother with her nails. It became fixed in her memory, probably because of the unusual facial expression of pain, reproof, etc., which followed it, until the close proximity of any one's face was a strong suggestion to her to give it a violent scratch. In order to break up this habit, I began to punish her by taking the hand with which she scratched at once, and snapping her fingers with my own first-finger hard enough to be painful. For about four weeks this seemed to have no effect, probably because I only saw her a small portion of the time, and only then did she suffer the punishment. But I then observed, and those who were with her most reported, that she only scratched once at a time, and grew very solemn and quiet for some moments afterwards, as if thinking deeply. And soon after, this climax was reached: she would scratch once impulsively, be punished, and weep profusely, then become as grave as a deacon, looking me in the face. I would then deliberately put my cheek very close to her, and she would sit gazing at it in "deep thought" for two or even three minutes, hardly moving a muscle the whole time, and then either suddenly scratch and be punished again, or turn to something (noise or object, watch-chain, etc.) near by. Having scratched, she began to cry in anticipation of the punishment. Gradually the scratching became more rare. She seldom yielded to the temptation after being punished, and so the habit entirely disappeared. I may add that her mother and myself endeavored to induce a different re-action by taking the child's other hand and gently stroking the face which she had scratched. This movement in time replaced the other completely, and now the soft stroking has become one of her most spontaneous expressions of affection.

Now, the interpretation is this, in terms of the foregoing pages: the first act of scratching was probably accidental, one of the spontaneous re-actions or physiological suggestions so common with an infant's hands; it passed, by reason of its peculiar associations, into a sensori-motor re-action whenever the presence of a face acted as suggestion,— so far, a strong direct stimulus to the motor centres. Then came the pain,—a stimulus, both direct and associative, to the inhibition of the foregoing. For a time the former was too strong; then there followed an apparent balance between the two; and finally the pain overcame the suggestion, and the re-action was permanently inhibited. The stroking re-action gained all the strength of violent and intense association with the elements of this mental conflict, and was thus soon fixed and permanent.

Taking this as a typical case of "deliberative suggestion," — and I could instance many others, less clear, from H.'s life-history,— my point is twofold: there is nothing here that requires will, meaning by "will" a new influence due to active consciousness (if we do call it will, we simply apply a different term to phenomena which in their simplicity we call by other names); and, second, suggestion is as original

a motor stimulus as pleasure and pain. Here they are in direct conflict. Can we say that H. balanced the pleasure of scratching and the pain of punishment, and decided the case on this egoistic basis? And, if suggestion be an original stimulus, why may it not be an altruistic suggestion, — my pain and your pleasure as well as your pain and my pleasure?

There are two (or more) suggestions, *sg* and *sg'* (Fig. 4), each either sensory or ideal. They arouse a motor process which is the union of two processes (*mp* and *mp'*). In the instance above, the scratch suggestion *mp* controls, gives the re-action *mt* and its consciousness *mc*.

4. *Imitative Suggestion.*— For a long period after the child has learned to use all his senses, and after his memory is well developed, he lacks entirely the instinct of imitation. I have been quite unable in H.'s case to confirm the results of Preyer, who attributes imitation to his child at the age of three to four months. I experimented again and again, and in a great variety of ways, but failed to get any thing like a decisive case of imitation till the eighth month; that is, till after the will was clearly beginning to show itself. During this period, however, H.'s consciousness was a rich field of suggestive re-actions of the other classes. There were, earlier, a few instances of apparent imitations of movements of opening and closing the hands, but they turned out to be

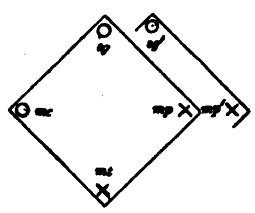

FIG. 4.—DELIBERATIVE SUGGESTION.

accidental. I think it likely that observers are often deceived as respects imitation, taking happy coincidences for true instances; yet it is possible that H. was peculiar in regard to this.

When the imitative impulse does come, it comes in earnest. For many months after its rise it may be called, perhaps, the controlling impulse, apart from the ordinary life processes. As a phenomenon, it is too familiar to need description. Its importance in the growth of the child's mind is largely in connection with the development of language and of muscular movement.

As a factor in motor development,— the aspect now before us,— the phenomena are plain enough, and may be divided into two general classes, called ***simple imitation*** and ***persistent imitation***.[1] By simple imitation I mean to characterize re-actions in which the movement does not really imitate, but is the best the child can do. He does not try to improve by making a second attempt. This is evidently a case of simple sensori-motor suggestion on the physiological side, and is peculiar psychologically only because of the more or less remote approximation the re-action has to the stimulating movement. If this were all that imitations are worth, we might omit their further treatment.

But in ***persistent imitation*** we have a very different phenomenon, — a phenomenon which marks the transition, as I conceive, from suggestion to will, — from the re-active to the voluntary consciousness. Such imitation is necessary, I think, as a stimulus to the tentative voluntary use of the muscles. Professor Bain's theory that all voluntary movements are led up to by accidental spontaneous re-actions which result in pleasure or pain, will not hold water for an instant in the presence of the phenomena of imitation. Suppose H. endeavoring in the crudest fashion to put a rubber on the end of a pencil, after seeing me do it,— one of her earliest imitations. What a chaos of ineffective movements! But after repeated efforts she gets nearer and nearer it, till at last, with daily object-lessons from me, she accomplishes it. Here, simply by imitation, one of the most valuable combinations for future manual manipulation is acquired. Suppose there had been no impulse to do what she saw me do, no motor force in the simple idea of the rubber on the pencil: what happy combination of Mr. Bain's spontaneous movements would have produced this result, and how long would it have taken the child if she had waited for experiences actually pleasurable and painful to build up this motor combination?

In cases of imitation there is no chance for association as such. The movements imitated are new as combinations. It is probable, it is true, that various ideas of former movements are brought up, and that the child has the consciousness of general motor capacity, resting, in the first place, upon spontaneous impulsive re-actions; but on this insufficient associational basis he strikes out into the deepest water of untried experience. For this reason, as was said above, I believe that persistent imitation comes only after there is will; meaning by "will," at this stage of it, that this consciousness of motor capacity is not held down to actual memories of past re-actions, but becomes generalized mentally and motorly beyond its legitimate physiological data. Physiologically, we would expect that the brain energy released by a new stimulus (pencil-rubber combination) would pass off by the motor channels already fixed by spontaneou, reflex, and associated re-actions; i.e., that the child would be content with a motor re-action of any kind. But not so. It is not content until it produces a new re-action of a particular kind, and we must suppose that in consequence of each effort of the child the physical basis is in some way modified, in so far violating strict nervous association, until the one re-action imitated is performed.

The peculiarity of persistent imitative suggestion, accordingly, is that it involves will, and yet is not a voluntary motor re-action. The muscular movements in putting on the rubber is not the child's pictured end: the idea of the rubber on the pencil is her end. Nor is she conscious of the motor re-action as a means to that end. It is probable that the muscular movements figure in her consciousness, if at all, only in the vaguest and most undefined associative way.[1] They represent simply the nervous channel into which the eye-stimulus empties itself.

Further, the re-action at which imitative suggestion aims is one which will reproduce the stimulating impression, and

[1] Preyer's distinction between "spontaneous" and "deliberate" imitation, Senses and Will, p. 293. He is wrong, I think, in making both classes voluntary. The contrary is proved for spontaneous imitation by the fact that many elements of facial expression are never acquired by blind children. We could hardly say that facial expression was a voluntary acquisition, however gradually it may have been acquired.

[1] See PREYER, Senses and Will, p. 254.

so perpetuate itself. When a child strikes the combination required, he is never tired of working it. H. found endless delight in putting the rubber on and off again, each act being a new stimulus to the eye. This is specially noticeable in children's early efforts at speech. They re-act all wrong when they first attack a new word, but gradually get it moderately well, and then sound it over and over in endless monotony. The essential thing, then, in imitation, over and above simple ideo-motor suggestion, is that *the stimulus starts a nervous process which tends to reproduce both the stimulus and the process again.* From the physiological side, we have a circular activity,— sensor, motor; sensor, motor; and from the psychological side we have a similar circle,— reality, image, movement; reality, image, movement.

The square to the left (Fig. 5) is the first act of imitation; the movement (*mt*) now stimulates (dotted line) the eye again (*sg'*), giving the second square, which by its movement (*mt'*) furnishes yet another stimulus (dotted line with arrow); and so on. The element of will makes slight changes in this diagram, but they may be omitted in this connection.

With the foregoing descriptions in mind, we may gather up the facts of suggestion. Particular statements of the

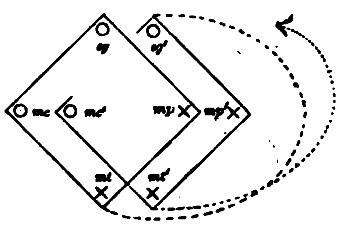

FIG. 5.—PERSISTENT IMITATION.

principle from the side of the nervous system are as follows:—

Physiological suggestion is the tendency of a reflex or secondary-automatic process to get itself associated with and influenced by other sensory or ideal processes. Perhaps the plainest case of it on a large scale is seen in the decay of instincts when no longer suited to the animal's needs and environment.

Sensori-motor suggestion is the tendency of all nervous re-actions to become secondary-automatic and reflex, seen in simple imitation and the passage of the voluntary into the involuntary.

Deliberative suggestion is the tendency of different competing sensor processes to merge in a single motor re-action, illustrating the principles of nervous summation and arrest.

Persistent imitative suggestion is the tendency of a sensor process to maintain itself by such an adaptation of its re-actions that they become in turn new stimulations.

And from the side of consciousness, suggestion in general is the tendency of a sensory or ideal state to be followed by a motor state.

Whether any simpler formulation of these partial statements may be reached, is a question which may be delayed until we have looked more closely at the voluntary life.

J. MARK BALDWIN.

NOTES AND NEWS.

BESIDES the hides of the alligator, of which fifty thousand or sixty thousand are annually utilized in the United States, there are other commercial products obtained. The teeth, which are round, white, and conical, and as long as two joints of an average finger, are mounted with gold or silver, and used for jewelry, trinkets, and for teething babies to play with. They are also carved into a variety of forms, such as whistles, buttons, and cane-handles. This industry is carried on principally in Florida. Among the Chinese druggists, as stated in the *Journal of the Society of Arts*, London, there is a great demand for alligators' teeth, which are said to be powdered, and administered as a remedy. As much as a dollar apiece is paid by them for fine teeth. All the teeth of the alligator are of the class of conical tusks, with no cutting or grinding apparatus; and hence the animal is forced to feed chiefly on carrion, which is ready prepared for his digestion. Other commercial products of the alligator are the oil and musk pods. The tail of an alligator of twelve feet in length, on boiling, furnishes from fifty to seventy pints of excellent oil, which, in Brazil, is used for lighting and in medicine. The oil has been recommended for the cure of quite a variety of diseases. It has a high reputation among the swampers as a remedy for rheumatism, being given both inwardly and outwardly. The crocodiles and alligators possess four musk-glands, — two situated in the groin; and two in the throat, a little in advance of the fore-legs. Sir Samuel Baker says they are much prized by the Arab women, who wear them strung like beads upon a necklace.

— A series of explorations of great interest have, during the past two years, been carried out by two French travellers, MM. Catat and Maistre, in little-known regions of the island of Madagascar. The results accomplished by these travellers were described by M. Grandidier, the well-known authority on Madagascar, at a recent meeting of the Geographical Society of Paris, an account of which is given in the "Proceedings of the Royal Geographical Society" for February. In the summer of 1889 the "Radama I." route from the capital to Tamatave was explored, with the result that it was found to be not so short or so practicable as the ordinary route. The travellers discovered a marshy zone called Didy, similar to the great lacustrine plain of Antsihanaka, lying between the central mountains and the coast range. Two days were occupied in crossing this hitherto unknown marsh, which gives rise to the river Ivondrona, one of the principal streams of the eastern part of the island. The travellers then proceeded to the bay of Antongil, with the intention of crossing the island along the 16th parallel; but M. Maistre was attacked by fever, and returned to Antananarivo, not, however, by the usual route, but through the province of Antsihanaka, which he found to be placed too far eastwards on recent maps. M. Catat, meanwhile, crossed the island from the east, and reached the west coast at Majonga. He found that the great central mountain mass does not extend, as hitherto supposed, to the 16th parallel; and that the great plains of secondary formation, with their characteristic vegetation of twisted and stunted Bourbon palms and other special trees, occupy here more than two-thirds of the country. The elevated zones of the eastern slope of the coast range are covered with forests, which belong to the first belt of forests running through the whole length of the island; but M. Catat found no trace in this region of the second belt, parallel to the first, which clothes the slopes of the central mountains between Ikongo and Antsihanaka. M. Catat returned from Majonga to the capital, up the valley of the Ikopa. The two explorers subsequently visited together the south of the island, where they discovered the sources of the Omlahy, which discharges itself into the Bay of St. Augustine, also those of the rivers Manambovo and Mandrary, and of one of the head streams of the Mananara, and were thus able to determine the watershed of the principal streams of this southern region. They returned from Fort Dauphin along the south-east coast to the mouth of the Mananara, which they ascended as far as Ivohibé, and surveyed the hitherto unknown course of this important river. Their collections will, it is stated, prove to be of much interest to anthropologists and naturalists.

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Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

American Zoölogists will certainly be glad to hear that the Zoölogical Station at Naples is once more open to them. Through the liberality of Major Alex. Henry Davis of New York a table has been secured until January, 1892, and now awaits its occupancy by some American investigator. Major Davis became interested in the matter while in Naples last January, and paid for a table during the current year in addition to promising his support and influence toward making the arrangement permanent. The United States has been represented at the Naples Station but twice since its foundation, although a score of American workers have enjoyed its privileges within that time. Williams College held a table for two years, and the University of Pennsylvania for one. Naturally the undertaking proved too expensive, and of too little value to any one institution to warrant the permanent maintenance of a table; and during the past six years only such Americans have been able to work there as have enjoyed the personal courtesy of the director, Professor Anton Dohrn, or as have been temporarily occupying tables of some European state. Last year two American workers were at the station, dependent upon the sufferance of German hospitality for their places, and had the very doubtful pleasure of seeing every civilized nation present in its representatives except their own. Now that the United States no longer occupies the anomalous position of being the richest and most prosperous nation of the world, and yet the one most indifferent to this grand international undertaking, American workers may hope to see the matter taken up by the national authorities or in some other definite way that will assure its permanency.

Alexander Winchell, LL.D., of the University of Michigan, died at Ann Arbor, Feb. 19. Professor Winchell was born at North East, N.Y., on the 31st of December, 1824, and graduated at Wesleyan University in 1847. The following year he became a teacher of natural science at Amenia Seminary in New York State, but only remained one year, removing in 1849 to Alabama, where he continued his work as a teacher in connection with several institutions. In 1854 he became professor of physics and civil engineering in the University of Michigan, but a year later he naturally gravitated to the professorship of geology and natural science, retaining the position until 1872. In 1859 he was appointed by the State authorities director of the Geological Survey, and pushed the work energetically until the outbreak of the war arrested its further progress. He was again connected with the survey in 1869, when it was resumed, but resigned two years later. From 1866 to 1869 he also held the corresponding chair in connection with the Kentucky University. In 1873 he left the University of Michigan to accept the chancellorship of Syracuse University, but held the place only one year, retiring to accept the professorship of geology, zoölogy, and botany; and again from 1875 to 1878 he did double duty, filling the same department in Vanderbilt University in connection with his duties at Syracuse. About this time he contributed a series of articles to the *Northern Christian Advocate*, published in Auburn, N.Y., in which he defended a belief in the existence of a pre-Adamite race, and also intimated his concurrence in the theory of evolution. For these views, deemed unsound by the authorities of Vanderbilt University, he was called upon to resign his professorship, but refused, and his lectureship was abolished. Quite a prolonged and bitter controversy was the result, and he fell into much disfavor among many of his fellowship in the Methodist Episcopal Church. In 1879 Professor Winchell was called to the chair of geology and paleontology in the University of Michigan, which he retained until his death. Among his works are many official reports and a number of books on evolution, and extensive contributions to scientific periodicals. His bibliography includes about two hundred titles.

THE ZIMBABYE AND OTHER RUINS IN MASHONALAND.

The following information regarding these famous ruins was received from Mr. E. A. Maund by the Royal Geographical Society, London, which he obtained from Mr. Phillips, in correction and amplification of the remarks made by him at the meeting of the society on the 24th of November, 1890.[1]

Mr. Phillips was all over that part of the country in 1866, and was with Mr. Hartley the year after, and saw many old gold-diggings near the hill which then first got its name of Hartley Hill. In 1868 he and Mr. Westbeach crossed the Hanyani and went down the Mazoe. In October, 1871, he was hunting at the junction of the Ingwesi and Lundi Rivers, when a letter was brought to him from Herr Mauch. It was not signed, but the writer reminded him of an adventure they had had together with five lions on the Mahalapsi, so that he might identify him. Mauch said he was living with a man named Renders (not Kinders), and was in a bad plight, having been robbed of every thing except his papers and gun. He begged him not to bring a Matabele with him, as they were living among the Mashonas. Phillips went and found Mauch and Adam Renders, an American, living on the top of a kopje, a few miles south-west of the ruins of Zimbabye. It was a pretty place. A waterfall coming down from the ridges above fell into a pan by the hut, in which it disappeared, to come out again in a gushing fountain several hundred feet below, a cave of refuge being close by, with water flowing through it, to which they and their Mashona hosts could fly, and barricade themselves in with a bowlder of rock, when Matabele raiding parties were afoot. Mauch told him of some ruins in the neighborhood, and next day the party went to see them.

It was really Renders who first discovered these ruins, three years before Mauch saw them, though Mauch and Baines first published them to the world, and they only described what the old Portuguese writers quoted by Mr. Maund talked of hundreds of years ago. Mauch, on their arrival at the Zimbabye ruins, asked what they thought of them. He (Phillips) confessed he was not greatly impressed, as they were exactly like several others he had seen in other parts of the country. There were the same zigzag patterns, and the mortarless walls of small hewn stones.

Shortly before, when hunting in the mountains to the west of Zimbabye, he had come upon a regular line of such ruins, one of which must have been a very large place. It had three distinct gateways in the outer wall, which were at least thirty feet thick at the base; and an immense ironwood tree, that would have taken hundreds of years to grow, had grown through a crevice in the wall and rent it asunder. On the side of a gateway were vast heaps of ashes, with occasional potsherds about, the only evidence of the old inhabitants.

[1] Proceedings of the Royal Geographical Society, January, 1891, p. 20.

He had found the same kind of ruins all over the country, very frequently on the summit of difficult kopjes. Those at Tati and Impakwe are good examples; but the most perfect, perhaps, of all lies north-west of Tati. The tower there is about sixty feet in length and breadth, and eighty feet high; the walls about fifteen feet thick; and it is entered by a passage winding spirally to the top, which is so arranged as to be commanded by archers from the interior all the way, and is so narrow that it admits of the passage of one person only at a time.

DEVELOPMENT OF MODERN MARINE ENGINEERING.[1]

THE development of modern marine engineering in the United States may fairly be said to have begun with the construction of the engines of the steamship "George W. Clyde," by William Cramp & Sons, in 1871, which were the pioneer two crank compound engines in America. Prior to this our engineers and machinists had brought the simple engine to its zenith of possible development, but with the advent of the compound engine that era ceased to be of interest except in the historical sense.

The discovery of the principle of expansion, and the theory of the compound engine based upon it, long antedate their practical application. The earliest works on steam engineering contain evidences of knowledge of the principle, and foreshadow the application of expansion; but the compound engine as a practical fact is only about twenty-four years old in England, and about twenty years old in the United States. Its success as a fuel economizer at once dominated the construction of simple engines, and all other American ship-builders were compelled to follow Cramp's lead.

From the "George W. Clyde," in 1871, to Mr. Jay Gould's celebrated steam-yacht "Atalanta," in 1882, a period of eleven years, the development of the compound engine was steadily pushed to its climax of air-tight fire-room, forced draught, and the highest boiler-pressure consistent with economy in double expansion. This limit was reached in the "Atalanta;" and during the intervening period Messrs. Cramp & Sons had built about 70,000 registered tons of iron steam shipping, besides a number of yachts and other small crafts.

The era of double expansion terminated in 1885, with the construction of the steam-yacht "Peerless," which was equipped with the first triple expansion engines built in the United States.

This remarkable little ship was built by Cramp & Sons on their own account, at a cost approximating $100,000, simply as a practical experiment in the direction of the advance from two to three expansions of working steam. The result of the experiment left no room for argument as to the efficacy of the new system; and, though a few merchant ships were afterwards built by them with ordinary compound engines, they were merely duplicates of earlier vessels, and none but triple expansion engines were ever afterward designed or recommended by that firm.

In the "Peerless," as an experimental ship, Messrs. Cramp & Sons went to what has since been recognized as the upper limit of economical boiler-pressure for the purposes of triple expansion, which was 155 pounds. The registered tonnage of the "Peerless" was 228 only, but her engines developed about 1,060 indicated horse-power, giving her a speed of 17½ knots, which made her the fastest steam-yacht of her time and class.

From the "Peerless" in 1885 to the "Vesuvius" in 1889 was a period marked by tremendous progress. In the latter vessel a power of 4,440 horses was developed in 258 tons weight of machinery, and applied to the propulsion of about 905 tons of displacement, the result being a speed of 21.65 knots an hour.

During this period Messrs. Cramp & Sons also built the horizontal triple expansion engines of the "Newark," "Philadelphia," "Baltimore," and "Yorktown," United States men-of-war, together with about 56,000 horse-power of triple expansion machinery for merchant vessels, a compound oscillating engine for the Stonington Steamship Line steamer "Connecticut" (with cylinders 56 inches and 104 inches respectively, and 11 feet stroke), — the largest engine of that type ever built, and carrying 110 pounds of steam-pressure,— together with several heavy compound pumping-engines for water-works, ranging in capacity from 10,000,000 to 20,000,000 gallons per day.

Advantage was taken of this school of development by the Navy Department, and Chief Engineer George W. Melville was stationed at the ship-yard of Cramp & Sons as inspector of machinery. While serving as such, Mr. Melville designed the engines of the cruiser "San Francisco," and laid broad and deep the foundation of that knowledge of marine engineering which, since his promotion to the chiefship of the Bureau of Steam Engineering, has found expression in a group of machinery designs aggregating over 150,000 horse-power, all of which are now in various stages of construction, and classed by all competent critics at home and abroad as representing advanced types of marine engineering in every sense.

The latest of Messrs. Cramp & Sons' engines brought to trial are those of the United States cruiser "Newark," which are of the horizontal, direct-acting, three-cylinder type. They weigh, including water in the boilers, 761 tons, and developed, on four hours' trial, 8,660 indicated horse-power, or 11.64 horse-power to the ton of weight, which exceeds any other performance of that type of machinery.

At the present time this concern has in the course of construction the machinery for two 10,000-ton battle-ships, one armored cruiser of 8,100 tons, and one protected cruiser of 7,300 tons, embracing, in all, eleven engines of approximately 60,000 indicated horse-power, of which three are to be placed in the latter vessel to drive triple screws, and designed to produce a speed of 21 knots.

It is quite generally conceded that, in the production of these colossal machines, the limit of size and weight of boilers of the cylindrical or tubular type has been reached; those for the armored cruiser "New York" having a diameter of 15.9 feet, requiring a shell plate thickness of 1.32 inches, and weighing 70 tons each when ready for installation on board ship.

The machinery plans for the 8,200-ton armored cruiser, and the 7,300-ton protected cruiser, present several interesting novelties. The first named is to be powered with four engines, two working on each shaft, and provided with means of disconnection so as to cruise under half power under ordinary circumstances. These four engines are installed in separate water-tight compartments. The power is 4,500 each, or 18,000 collectively, and is expected to produce a speed of twenty knots.

In the 7,300-ton protected cruiser there are to be three engines, on three shafts. Two of the engines, driving the port and starboard shafts, are placed in the usual manner on twin screw vessels. The third, driving the central shaft, is placed abaft the other two, each having its own compartment.

These are to be among the most powerful machines ever built, having 7,000 indicated horse-power each, or 21,000 collectively, and are to produce a speed of twenty-one knots.

[1] From The Crank.

SUBMARINE GUNS.

C. S. BUSHNELL of New Haven, vice-president of the Ericsson Coast Defence Company, which has just had the old "Destroyer" taken out of the Brooklyn Navy Yard and hauled up on Simpson's dry dock at South Brooklyn for repairs, says, in the *New York Times*, in regard to the fitting-up of the vessel for the trial of a newly invented gun, —

"On the 'Destroyer' the late Capt. Ericsson and C. H. Delamater spent $150,000. The vessel is 120 feet long, and is substantially constructed, though now in great need of repairs. Our company has a capital of $250,000. We are fitting up the vessel for the purpose of testing a gun that will fire under water. Now, with the heavy nettings which the big war-vessels have for the protection of themselves against torpedoes, the ordinary projectiles are almost useless.

"But with the gun that is to be tested on the 'Destroyer' we can make a projectile penetrate any of the nettings that are now in use. We are to use a sixteen-inch gun. That which we will experiment with is being constructed at Bethlehem, Penn., and is about half done. It is to be 85 feet in length. The projectile is to be 25 feet long, and to throw it a charge of twenty-five

pounds of powder will be used. The shell will contain from 300 to 400 pounds of nitro-glycerine, enough to blow up any vessel afloat if struck right. The muzzle of the gun will protrude for ten feet under water, and the projectile will be carried from 750 to 1,000 feet. The projectile will extend eight feet beyond the muzzle of the gun before firing. We intend to try the gun for the first time at Newport next July, having obtained from Congress an appropriation for making the tests.

"With a few such vessels as the 'Destroyer' will be when equipped with our gun, the armed fleets of the world could be swept out of existence. I believe that this invention will revolutionize naval gunnery throughout the world. One of our shells can be sent right through the netting and into the side of a vessel, where a torpedo could not penetrate. Commodore Folger of the Ordnance Department has written a letter to me. saying that he has prepared a heavy steel netting for a target, upon which our gun can be tested. Later we shall buy an old hulk and blow it up with one of our percussion shells, to show the efficacy of the new gun.

"I think that if the test proves satisfactory the government will arm some of the naval vessels with it. For the price that one of our big new ships would cost we could build and arm five of the smaller ships, which would be able to sink the best navy afloat. If the nations should arm their navies with these guns, it would so enhance their destructive power that the powers would not dare to go to war with each other. Since ships have been armed with the Hotchkiss rapid-firing guns, there has not been a naval battle. In a sea fight these guns would cause terrible havoc. Vessels of the 'Destroyer' type are to be heavily armored, so that they can approach any vessel without being injured. These vessels will be only a foot out of the water, and that part will be armored, so very little will be exposed to an enemy's guns. One of these vessels, made to steam at great speed, can be made very effective."

Mr. Bushnell was associated with Ericsson in the construction of the "Monitor."

HEALTH MATTERS.

African Arrow Poison.

THE poisons used by the natives of Africa to render fatal the wounds made with their arrows, as described by Mr. Stanley in his recent work on Africa, are, when fresh, of most extraordinary power. Faintness, palpitation of the heart, nausea, pallor, and beads of perspiration break out over the body with extraordinary promptness, and death ensues. One man is said to have died within one minute from a mere pin-hole puncture in the right arm and right breast; another man died within an hour and a quarter after being shot; a woman died during the time that she was carried a distance of a hundred paces; others died in varying spaces of time up to a hundred hours. The activity of the poison seemed to depend on its freshness. The treatment adopted, as we learn from the *Medical and Surgical Reporter*, was to administer an emetic, to suck the wound, syringe it, and inject a strong solution of carbonate of ammonia. This carbonate-of-ammonia injection seems to have proved a wonderful antidote, if it could be administered promptly enough. One of the poisons with which the weapons are smeared is a dark substance like pitch. According to the native women, it is prepared from a local species of arum. Its smell when fresh recalls the old blister plaster. It is strong enough to kill elephants. This poison is not permitted to be prepared in the village. It is manufactured and smeared on the arrows in the bush. These results of the African arrow poison are quite remarkable; but it would be interesting to know if they owe any thing to fear and its effects, or if similar results can be obtained by inoculating the lower animals.

Inoculation of Dog Serum as a Remedy for Tuberculosis.

In a series of communications made in the course of the last two years to the Société de Biologie, MM. Héricourt and Richet have given the results obtained by the injection of the blood of an animal refractory to tuberculosis, such as the dog, into the economy of one susceptible to the onslaughts of the bacillus. They have demonstrated experimentally, according to the *Lancet*, that such a proceeding exerts a retarding influence on the evolution of tuberculosis artificially communicated, without, however, stopping it altogether. With a view of intensifying these partially protective properties of canine blood, they inoculated the dog with a large dose of very active tuberculous matter, and one month later (the animal having lost flesh, and exhibiting manifest signs of ill health) injected into the peritoneal cavity of three rabbits seventy cubic centimetres of the dog's blood. A week later these rabbits were, with three other test-rabbits, inoculated with strong tuberculous virus, with the result that in twenty-five days two of the latter had succumbed, the rest surviving. Their ultimate fate is not recorded. Encouraged by these results, MM. Héricourt and Richet have extended the application of their method to tuberculous human beings, employing the serum only, and selecting the interscapular region as the seat of inoculation. M. Richet reports (Société de Biologie, Jan. 24) that four phthisical men have, since the early part of December, 1890, been subjected to this novel treatment. The results obtained seem to warrant the assumption that the introduction of the serum of dog's blood into the human economy counteracts, to some extent at least, the noxious influence of Koch's bacillus.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Can One see the Blood-Corpuscles in his own Eyes?

To some this may seem an idle question, — an absurdity; but when we remember that the sensitive layer of the retina is on the back side, and that there are blood-vessels in front of it, it may not seem so improbable. Nevertheless, the ease with which it may really be done is quite surprising.

If the eyes are turned toward a dimly lighted blank space, and adjusted to see distant objects, or as when we "gaze on vacancy," there will appear flitting across the illuminated area small bright spots. They will seem to flash into vision, pass over a few degrees, usually in a curved path, then suddenly disappear. The circumstances found favorable for observing this phenomenon are to look toward the sky or a snowy surface on a cloudy day, or on a brighter day with the eyes nearly closed. Seldom more than a dozen of these luminous points may be seen at once, and usually not more than two or three distinctly.

They may be easily distinguished from the tear-drops trickling over the front of the eye, which are often visible at nearly the same time, by their being of uniform size, and moving rapidly in different directions; while the tears are of variable size, like raindrops on a window-pane, and move slowly downward, or by the motion of the eyelids upward.

They are not to be confounded with *muscæ volitantes*, which are of variable shape, size, and color, and, besides, slow of motion, and not so quickly disappearing.

That these minute bodies are really red corpuscles floating through the retinal capillaries, is indicated by the following facts: —

1. They move in definite paths. Having noted one, another will be seen to pass exactly the same path in from half a second to two seconds.

2. They always move in the same direction in the same path, never back and forth.

3. They are of uniform size, and appear to be of a yellowish color.

4. By comparing them with objects of known size at known distances, they have been approximately estimated to correspond in size to red corpuscles. Accurate measurements seem impracticable from the nature of the case.

The reason that they are visible while the capillaries in which they float are not, is easily explained by the familiar principle that we become insensible to that which is constantly present, and are specially impressed by that which is transient or novel. The familiar experiment of Purkinje shows us that the capillaries may become visible when light comes from a novel direction, so

as to throw their shadows on a new portion of the rod-and-cone layer. From the nature of the case, the corpuscles cannot be rendered invisible, like the capillaries.

The phenomena described above were first observed by the writer a dozen years ago; and, though it is probable that others have observed the same, consultation with persons and books that would be likely to furnish the information of such knowledge have shown that these facts are either unknown, or at least not generally known. That the facts here published may be observed by any one seems proved by the fact that they have been corroborated by almost every one who has made the attempt under the writer's direction.

J. E. TODD.

Tabor College, Tabor, Io., Feb. 16.

Classification of American Languages.

IN your issue of Feb. 6 appears an article by Major J. W. Powell, chief of the Bureau of Ethnology of the Smithsonian Institution, on the study of what he calls "Indian" languages, with a list of families in the United States.

This article contains statements so much at variance with the leading authorities in linguistic science, that they should not be allowed to pass in silence.

In the first place, the term "Indian languages," applied to those spoken by the native tribes of this continent, is a misnomer based on an ancient blunder, and has been repudiated by all modern writers of weight. The so-called "Indians" are the "American race," and their languages are "American languages," by the common consent of ethnographers. Is the Bureau of Ethnology a sanctuary for the preservation of exploded errors, that it throws its influence into the scale to perpetuate this discarded blunder?

Much of the article alluded to is devoted to explaining and defending the nomenclature adopted by the bureau. In several points it requires still further defence. The arbitrary assumption of the date 1336, anterior to which the "law of priority" is decreed not to hold good, is not justified by the reasons given.

The dictum that "no family name shall be recognized if composed of more than one word," is not merely arbitrary, but has nothing in its favor and much against it. Frequently a class-name compounded of two words is particularly useful, as conveying a much wider idea than a single word. This is fully recognized by the best linguists of the day. Thus, Friedrich Müller employs the terms "Indo-Germanic," "Ural-Altaic," etc. The reasons assigned for rejecting such compounds are quite inadequate, and contrary to the practice of the highest authorities.

The adoption of the termination *an* or *ian* to denote families or stocks of languages is not original with our Bureau of Ethnology, though the article might lead the reader to suppose it a new device. Some writers adopted it long before the bureau was organized, but the plan did not meet with general approval. The cacophony of such words as "Eskimauan," "Muskhogean," etc., in Major Powell's list is apparent to every one who has not had the advantage of that training by the bureau to which he refers with pride as destroying all sense of euphony.

But the portion of the article in question which will most completely "knock the wind" out of those old-fogy linguists in Europe, and those in our own country who have been reared on Aryan and Semitic tongues, is Major Powell's declaration that "grammatic similarities are not supposed to furnish evidence of cognation;" that in his classification grammatic structure has been neglected, and lexical elements only considered.

Now, if it were said that in most instances we are obliged to depend on lexical elements because the grammatic structure has not been ascertained, the position would be sound and in accord with the recognized principles of the science of language; but to place the words of a tongue above its grammar in instituting comparisons is a feat of such daring or of such ignorance, that it requires a man long accustomed to frontier life to venture it. If there is any one principle in modern linguistics which we may look upon as thoroughly established, it is that the grammatic framework of a language is incomparably more stable than its lexicon. If there has ever been an instance where a language of agglutination has changed into one of inflection, it is not recorded "in the books." It is precisely the grammar which is the permanent part of a language, and not its vocabulary. Modern Turkish has borrowed three-fourths of its words from Arabic, Greek, Persian, etc.; but its grammar remains almost precisely that of the pure stock, the Yakut of the delta of the Lena. This principle is as true of American tongues as of others, and the evidence of it has been abundantly set forth by Friedrich Müller and Lucien Adam.

D. G. BRINTON, M.D.

Philadelphia, Penn., Feb. 20.

The Food of Moles.

IT is stated in the "Encyclopædia Britannica" that moles are entirely carnivorous, are exceedingly rapacious, and will die if left longer than eight or ten hours without food. I recently kept a living mole for a time to study its habits. I shut it in a ventilated wooden box, giving it a tin lid full of water, and some grains of corn. It drank the water, refused the corn, and, while kept strictly in the dark, was quiet. After twelve hours' captivity I offered it boiled rice, which it refused. After sixteen hours' fasting, it ate bread and milk, though not freely. When I had had it twenty hours, I gave it cracked oats, soaked well in milk, but uncooked. This it ate ravenously. I then released it in the room, and it travelled about, seeking a place to burrow, and made itself troublesome tearing at the carpet and upholstery. I threw down a large thick woollen mitten, which it speedily found and entered, thrusting its head into the thumb. If undisturbed, it would hide in this way for hours, the light and warmth of the room seeming greatly to annoy it. It lived in the mitten for three days, coming out to eat oats soaked in milk, but refusing cooked oats. It was given one small meal of raw meat. At the end of four days it was killed, being apparently in a healthy condition, and not having lost any flesh.

JULIA MCNAIR WRIGHT.

Fulton, Mo., Feb. 20.

Cold and Warm Waves.

TWO rival theories have been propounded recently regarding the origin of the waves or masses of cold air which appear to traverse the country toward the east. One of these finds the source of cold in the upper regions of the atmosphere, and considers that the cold air above mixes with that below, and thus gradually approaches the earth's surface. Those supporting the other theory, however, deny that any considerable cold can be brought down in this way, because the compression to which the air would be subjected would heat it, but they claim that the cold is due to the radiation of heat through the very clear sky which is a well-nigh invariable accompaniment. Without expecting to establish the exact truth in this matter, it has yet seemed a subject of much importance; and it may be well, at this stage in the discussion, to set forth a few facts that may be of use in the final solution of the problem.

Those who have been making forecasts of the weather have recognized for more than a dozen years three great classes of temperature falls: 1. Those which come with the advance of areas of high pressure; 2. Those which follow immediately in the rear of great storms independently of any high area; 3. Those which occur under a combination of these two causes. It should be noted that the first two classes do not invariably occur even when the conditions seem favorable, and great care is needed in examining other conditions, which, though apparently remote, may yet become exceedingly important factors in the development of the cold wave. The occurrence of the cold is independent of the wind, though the extent of the wave is markedly dependent on the rapidity of its advance, and a rapid motion has a tendency to increase the wind. Some have thought that the wind brings the cold; but this cannot be the case, for often there is no wind, or at least it rarely attains fifteen miles per hour, while the cold wave advances at double that velocity. One of the essential conditions needed for a cold wave is an elimination of the moisture in the air, and this removal of moisture is oftentimes very remarkable. In one case three-fourths of this moisture was removed in 110

minutes. This action may precede the fall in temperature by several hours, or the two may be very near each other, but it is very rarely that the diminution of moisture does not take place with sufficient rapidity to prevent the formation of fog from the lowering of temperature to the dew-point. The cause of this marked drying it is not easy to find; but it is not due to a drying wind along the earth's surface, though it may be due, in part, to a settling of dry air from above.

What causes the cold wave? The simplest explanation would be that the air radiates its heat to the abnormally clear sky; but such radiation from the air, it is generally recognized, would produce a very slight cooling. That this cooling is slight can often be determined when no cold wave is in progress. It is a significant fact that the cold wave strikes the high mountain summits before it does the base; for example, it has been shown that the temperature change at Mount Washington (6,279 feet) occurs from five to ten hours earlier than at the base. The same effect has been noted at Pike's Peak (14,134 feet), and there is no reason to doubt that it may be due to changes in the upper atmosphere many miles above our highest mountains. Does the cold air sink by gravity? The most serious objection to this view is that such action would seem to call for a displacement of the warm air beneath, or an admixture of the cold and warm air, at a much more rapid rate than can be accepted. The objection that such action would warm up the air from compression does not seem to be well taken. Certainly the appearance of the temperature fluctuation, which is precisely the same below as above, at Mount Washington, for example, shows no marked heating at the base. If we increase the density of air by pressure from outside, it would undoubtedly be warmed, but it is plain that air could not descend by gravity into other air (whether by displacement or admixture) unless it were denser than that below, and in such case the natural expansion would tend to slightly cool the air. Some have advanced such an idea in accounting for increased cold in the outskirts of an expanding cold wave, but it is very evident that such an effect would be well-nigh inappreciable. There is one fact that seems to show a tendency to a settlement of the upper air, in that the removal of the moisture occurs before the fall in temperature. This would seem to corroborate the view that the cool, dry air from above is slightly heated at first by contact with the lower air, and possibly by compression, and hence the drying process may anticipate the great cooling, though, according to my belief, such action is not at all needed to dry the air.

Both of these causes are concerned in some degree in our cold waves, but they do not seem to account for all the facts. Whatever the ultimate cause may prove to be, it is unquestionably related in a marked degree to the removal of moisture from the air; and until we can satisfactorily explain that, we cannot hope to explain the other. The intensity and extent of the cold wave are dependent upon the rapidity of the advance of this drying condition; and it is safe to say that this advance, whether in the front of a high-pressure area or in the rear of an area of low pressure, is entirely independent of the motion of a mass of air. The best proof of this is to be found in the fact that the high area, storm, and drying condition all advance at thirty, forty, or more miles per hour, while the air moves at less than half that velocity.

This brings us to the most important deduction to be made from this discussion. If there is no horizontal transfer of air in our cold waves, we may conclude that there is none in our warm waves. I am well aware that this proposition, already fully set forth in the *Scientific American* for Nov. 15 of last year, will call forth most serious opposition, as it strikes at the very heart of present theories of storm-generation. If the sun heats a limited portion of the earth's surface, and thus starts up an ascending column of warm, moist air, then our storms may be due to the forward motion of this column of ascending air which rotates at the same time that it advances; but, if there is no motion of air-particles in our storms, this theory falls to the ground. There have been set forth from time to time most serious objections to the ordinary theories, but it seems to me none have had the weight of this one here presented. This rise in temperature occurs in the upper air before it does at the earth, and is due, in part, to a condition of the atmosphere which seems to intercept the heat of the sun. This condition is exactly contrary to that in a cold wave, and is brought about by a marked aggregation of moisture in our storms. This aggregation seems to take place far above our highest mountains.

We may conclude as follows:—

1. High-pressure areas and storms (or low-pressure areas) are conditions brought about by some effect other than the abstraction or addition of heat. Possibly they are produced by some form of electric energy, and are transported or transferred through the air without the motion of air-particles.

2. A portion of the cold in our cold waves is due to radiation, and another portion to the cold of the upper atmosphere, while possibly a larger portion cannot yet be accounted for.

3. A portion of the heat in our storms is due to a peculiar condition of the atmosphere which intercepts the heat of the sun, and this heat gradually works down from the upper atmosphere to the earth.

H. A. HAZEN.

Washington, D.C., Feb. 23.

The Instruction of the Deaf.

I DO not desire to take part in the discussion now going on in *Science* concerning the comparative excellence of the various methods of instructing the deaf. The truth with respect to these methods has recently been happily expressed by Miss Yale, the able principal of one of our best oral schools ("Twenty-third Annual Report of the Clarke Institution for Deaf-Mutes," 1890, p. 15): "Each system claims for itself distinctive merits and special adaptation. The justice of these claims is now generally conceded by the great body of those engaged in teaching the deaf."

I wish merely to correct an erroneous statement in Dr. Alexander Graham Bell's open letter to the Hon. William B. Allison, published in the last number of *Science*, with respect to the Columbia Institution for the Deaf, with which I have been connected for twenty-five years. Dr. Bell says, "3. In the Columbia Institution a foreign language (the sign-language) is used as the medium of instruction, whereas the rival methods employ the English language alone for this purpose."

In the Columbia Institution the sign-language is not used as *the* medium of instruction. In some classes it is used as *a* medium of instruction, being employed to communicate with deaf children at the beginning of their course, when they have no other means of communication whatever, and to promote their mental development, with respect to which Dr. Bell himself has said ("Proceedings of the Fifth Conference of Principals of Schools for the Deaf," 1884, p. 195), "In regard to mental development, undoubtedly nothing could reach the mind of a child like the language of signs;" it is also used, but very sparingly, in the earlier part of the course of instruction in connection with the English language, to explain and illustrate the meaning of words, where otherwise the explanation could not be given at all; and it is used throughout the whole course for public lectures and devotional exercises, no means of using the English language having yet been discovered which will satisfactorily take its place for this purpose.

Under all other circumstances — and these comprise the great part of the teaching given in the institution — the English language is the medium of instruction. There are classes in both the Kendall School and the National College — the two departments of the Columbia Institution — in which the English language is the only medium of instruction. I do not think that any of the schools following "rival methods" use the English language as a medium of instruction more than the Columbia Institution does.

EDWARD ALLEN FAY.

National Deaf-Mute College, Kendall Green, Washington, D.C., Feb. 28.

P. BLAKISTON, SON, & CO., Philadelphia, will publish in March "A New Systematic Work on Surgery," by C. W. Mansell Moullin, surgeon to the London Hospital. They have also nearly ready "Plain Talks on Electricity and Batteries," for medical men, by Dr. Horatio R. Bigelow.

BOOK-REVIEWS.

Petrarch: A Sketch of his Life and Works. By MAY ALDEN WARD. Boston, Roberts Bros. 12°. $1.25.

A WELL-WRITTEN biography of Petrarch in English is a good book to have; and Miss Ward, we think, has here supplied it. Her work is of moderate dimensions, yet it gives all the information about Petrarch that English readers are likely to need, and it is written in a plain yet easy and flowing style. It recounts the main events of the hero's life, his travels, his many friendships, his multifarious occupations, and his popularity, while at the same time keeping always in view the intellectual work for which posterity honors him. His personal character is made known to us by his letters and other works, and especially by his "Letter to Posterity," which is really an autobiography; and as thus revealed to our view he appears as an extraordinarily active, agreeable, and popular, but somewhat vain man, imbued with an intense passion for antiquity and for the political unification of Italy. Miss Ward, while evincing much admiration for Petrarch's sonnets, thinks, nevertheless, that his real life-work — "one of far more importance and far wider influence than any of his writings, whether Latin or Italian — was the opening of the gates of antiquity to the modern world." This seems to us perfectly just. Sonnets, we apprehend, have little interest for intellectual men at the present day, and will have still less in the years to come; but the men who led the way in reviewing the Greco-Roman civilization can never cease to be important in the history of human progress. That Petrarch was one of the foremost of these as well as one of the earliest, is what gives him his chief claim on our gratitude; and all who are interested in the story of that great awakening will find much pleasant reading and food for reflection in Miss Ward's little book.

AMONG THE PUBLISHERS.

THE observations made at the Blue Hill Meteorological Observatory, and the investigations of the New England Meteorological Society, are now published in the "Annals of the Harvard College Astronomical Observatory." The Blue Hill observations for 1889 include the continuation of the tabular records of previous years, with monthly and annual summaries of hourly values, with an introduction by Mr. Rotch. The record is discussed and published with exceptional fulness. The cloud observations carried on by Mr. Clayton are published in detail; and present a mass of fact from whose reduction we shall expect to see very interesting and novel results. Considering that cloud-movement is much more steady than the movement of surface wind, it is singular that instrumental means, such as are here employed for determining the direction and relative velocity of cloud-drift, have not been more generally introduced. They might at least be introduced at a number of signal-service stations in different parts of the country, in order to test the possibility of their use in storm prediction; for the methods of weather forecasting now in use cannot be regarded as satisfactory. A feature of the Blue Hill station is the relative small and irregular diurnal variation of the various weather elements: even the mean hourly temperature ranged only from 48° to 52.5°. The wind velocity, cloudiness, and rainfall are almost independent of the time of day. All these factors are, however, well known to be dependent closely on the position of passing cyclonic storms; and if referred to these controlling disturbances, instead of to the relatively unimportant changes from day to night, the natural variations of wind, cloud, and rain would undoubtedly stand forth in their true distinctness.

— The "Ninth Annual Report of the Director of the United States Geological Survey" is of somewhat less size than its two-volume predecessor, but is fully up to the average of the earlier seven volumes. Besides the administrative reports of the first two hundred pages, it contains an account of the Charleston earthquake of 1886, by Capt. C. E. Dutton; the geology of Cape Ann, by Professor N. S. Shaler; an explanation of the formation of travertine and silicious sinter in the hot-springs of the Yellowstone National Park, by W. H. Weed; and an essay on the geology and physiography of parts of Colorado, Utah, and Wyoming, by Dr. C. A. White. Capt. Dutton's report is full of interest. The accounts of the earthquake and its effects, as presented in his memoir, will at once become the standard classic for this country, and the illustrations of damaged buildings will furnish material for all the new geographies and geologies for many years to come. The depth of the earthquake focus is placed at twelve miles, with a probable error of two miles. The velocity of the wave is determined to be about three miles a second, decidedly greater than has been found in other shocks; but, as the determination is based on good observations, the author is disposed to give it great weight, and to discard earlier results. Mr. Weed's essay on the travertine and silicious deposits of the hot-springs of the Yellowstone Park brings to light a process heretofore little suspected. The terraced formations of the springs are found to have been formed in great part by the agency of a low form of algous vegetation. He concludes that the plant life of the Mammoth Hot Springs causes the deposition of travertine, and is a very important agent in the formation of such deposits; that the vegetation of the hot alkaline waters of the geyser basins eliminates silica from the water by its vital growth, and produces deposits of silicious sinter; and that the thickness and extent of such deposits prove the importance of such vegetation as a geological agent.

— John Wiley, one of the oldest publishers in the United States, and well known among scientific men as the founder and head of the publishing-house of John Wiley & Sons, which has brought out so many engineering and scientific books in this country, died at his home in East Orange, Feb. 21. Mr. Wiley was born in Flatbush, L.I., Oct. 4, 1808, but his parents removed shortly after to New York. At seventeen he entered his father's store, the firm then being Wiley, Lane, & Co. Later, upon the death of his father, he succeeded to the business, G. P. Putnam being his partner at the time. Charles Wiley, his son, was admitted to the firm about forty years ago; and later William H. Wiley, well known among engineers, was also admitted, the firm name being changed to John Wiley & Sons. For nearly fifty years the office was in the old Mercantile Library building, recently demolished. Mr. Wiley was married in 1833 to Elizabeth S. Osgood. They had five children,— three sons and two daughters. Mr. Wiley was one of the original founders of the Church of the Puritans, this city, of which the Rev. Dr. Cheever was the pastor for so many years. He was an active member of the American Home Missionary Society, and for many years its president. He was also an active member of the Congregational Union of New York. He removed to East Orange in 1851.

—G. P. Putnam's Sons have in preparation "The Life and Writings of George Mason of Virginia," in the Early Statesmen Series; "Chapters on Banking," by Professor Dunbar of Harvard, and "The Industrial and Commercial Supremacy of England," by the late Thorold Rogers, in the Economic Monographs; and "Drinking-Water and Ice-Supplies," in Dr. Prudden's Health Manuals.

— The long-delayed Monograph I. of the Geological Survey on Lake Bonneville, an extinct lake of the Utah basin, by G. K. Gilbert, is at last published. The general character of the history of this ancient lake was given by the same author a number of years ago in the "Second Annual Report" of the survey; and in a later report there was an essay by him on the topographic features of lake shores, now reprinted, with little change, as constituting an element in the discussion of the Utah basin. As now presented, the entire essay is a model of elaborate and deliberate discussion. Taking the present monograph with the one on Lahontan by Russell, who was associated with Gilbert in the study of the Great Basin, it may be safely said that no other area of interior drainage in the world has received so complete an examination, nor has yielded results of such wide importance. The sensitiveness of interior lakes to variations in the relation of rainfall to evaporation renders them of the highest value as indicators of climatic changes in the past. With this point in mind, the interpretation of their deposits discloses the existence of two moist periods, with an interval of dryness; and these are correlated with the two glacial and the single interglacial epoch, not only by

inference, but by the direct association of morainic deposits with the lake beds. The volcanic manifestations during and after the existence of the lakes, and the faults occurring in the shore deposits, add interesting complications to this remarkable region.

— Professor J. C. Smock, lately appointed chief of the New Jersey Geological Survey, where he some time ago served as assistant under the late director, Professor Cook, has prepared a report on the building-stones of New York, issued in the second volume of the bulletins of the University of the State of New York, where Professor Smock has been engaged as economic geologist of the State Museum for several years past. Reference is made to previous works of the kind, such as Julien's "Report on the Building-Stones of New York" in the Tenth Census, Merrill's "Building and Ornamental Stones in the United States National Museum," the author's quarry list in a previous bulletin, and others. The bulletin contains an introductory statement of the classification adopted: namely, crystalline rocks, embracing granites and gneisses, trap rocks, and limestones and marbles; second, fragmental rocks, including sandstones, conglomerates, and slates. The limestones and sandstones are further arranged according to the geological formations from which they are obtained. A hundred pages are then given to a recital of the localities of quarries throughout the State. The uses, tests, and durability of the different kinds of stones occupy as many more pages. Under the first of these headings, we find a list of stones used in the more important buildings all over the State. A map is given at the end of the volume, with the names of quarry districts underlined in red.

— The first geological survey of Ohio was undertaken in 1836, and continued for two years. The work then lapsed until 1869, when it was begun again with greater vigor, Professor Newberry being in charge; and under his direction and that of his successor, Professor Edward Orton, numerous reports were issued down to 1888. Owing to the reckless and irregular method of distributing these volumes, complete sets are not often found, although editions of 20,000 of certain volumes were printed. In 1889 a third organization of the survey was made, and it is now regarded as a continuous official department of the State. Professor Orton is still in charge. The first annual report under these new conditions is just issued. It gives a brief review of the previous surveys, from which the above notes are taken; a general sketch of the results of the previous surveys, with corrections of certain earlier statements in the light of recent explorations; and a large amount of material concerning the natural gas and oil, which have attracted so much attention during the past six years. The extraordinary abundance of the natural gas is only equalled by the reckless manner in which it has been wasted. It is already decreasing, and, in Professor Orton's opinion, should be reserved chiefly for domestic uses. An excellent review of the theories accounting for the occurrence of oil and gas is given. This report

Publications received at Editor's Office, Feb. 16–21.

Aluminum Age. Vol. I. No. 1. *m.* Newport, Ky., C. L. Hartsfeld. 8 p. f°. 25 cents per year.
Call, Annie Payson. Power Through Repose. Boston, Roberts. 169 p. 16°. $1.
Cotterill, J. H., and Slade, J. H. Lessons in Applied Mechanics. London and New York, Macmillan. 512 p. 16°. $1.25.
Coues, E. "A Woman in the Case" ("The Biogen Series," No. 6). Boston, Occult Publ. Co. 54 p. 24°.
Graham, R. H. Geometry of Position. London and New York, Macmillan. 192 p. 12°. $1.75.
Greenough, J. B., *ed.* Livy. Books I. and II. Boston, Ginn. 270 p. 12°. $1.35.
Lincoln, D. F. Hygienic Physiology. Boston, Ginn. 206 p. 12°. 90 cents.
Mason, L. W., and Veazie, G. A., jun. The New Fourth Music Reader. Boston, Ginn. 282 p. 8°. $1.05.
Reclus, E. Primitive Folk. Studies in Comparative Ethnology. New York, Scribner & Welford. 339 p. 12°. $1.25.
Shoemaker, J. V. Heredity, Health and Personal Beauty. Philadelphia and London, F. A. Davis. 422 p. 8°. $2.50.
Ward, May Alden. Petrarch: a Sketch of his Life and Works. Boston, Roberts. 298 p. 12°. $1.25.
Young, C. A. Lessons in Astronomy. Boston, Ginn. 357 p. 12°. $1.30.

is distributed gratis by the members of the General Assembly of Ohio, but, if any one wishes, he may buy it for fifty cents.

— The "Investigations of the New England Meteorological Society" for 1889, includes, besides the usual tabular summaries, three essays on "Weather-Types in New England," "The Sea-Breeze on the New England Coast," as observed in 1887, and the "Characteristics of the New England Climate." The greater part of these are contributed by the director, Professor W. M. Davis of Harvard College, and Professor W. Upton of Brown University. The essay on weather types opens a line of writing that might be taken up to advantage in other State weather services, where some addition to the monotony of the annual tabular reports would be refreshing. The study of the sea-breeze is based on the reports of about a hundred volunteer observers on and near the eastern coast of Massachusetts, from Newburyport to Plymouth. The irregularity of the occurrence of the breeze is so great that it does not appear a hopeful subject for further study. Professor Upton summarizes the climate of New England under the following headings: changeable and unsettled weather; great ranges of temperature, both daily and annual; variation of seasons from year to year; equable distribution of temperature; and variety of local features from the low southern coast to the mountainous northern interior.

— In *Lippincott's Magazine* for March, 1891, the first instalment of "Some Familiar Letters by Horace Greeley" form an interesting feature. This is a series of letters written by Horace Greeley to an intimate friend, and covers the period immediately preceding and during his political campaign. These letters are expected to remove many unfounded prejudices. Another of the series of "Round-Robin Talks" appears in this number. Among the guests are Paul B. Du Chaillu, George W. Childs, T. P. Gill, M.P., George Parsons Lathrop, Julian Hawthorne, and others. The *pièce de résistance* of this instalment is the story told by Paul Du Chaillu of his discovery of the gorilla in the wilds of Africa.

A NEW MONTHLY
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We have great pleasure in announcing to our readers that we have decided to publish the journal monthly instead of quarterly. For the present year, as an experiment, the annual subscription will remain the same as heretofore.

CONTENTS OF JANUARY NUMBER:

To Our Readers.
Presidential Address
Steps in our Knowledge of the Organic World.
The Mountain Sphinx.
Appendicularia, with its "Haus," Illustrated.
Koch's Remedy for Tuberculosis.
Aspect of the Heavens—January.
Half-an-Hour at the Microscope, with Mr. Tuffen West.
Foraminifera from Atlantic Soundings.
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VIII. THE FIRST YEAR OF CHILDHOOD. By J. MARK BALDWIN.

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SCIENCE

[Entered at the Post-Office of New York, N.Y., as Second-Class Matter.]

NINTH YEAR.
VOL. XVII. No. 422.

NEW YORK, MARCH 6, 1891.

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CALENDAR OF SOCIETIES.

Women's Anthropological Society of America, Washington.

Feb. 28.—Alice C. Fletcher, Races in Africa.

Philosophical Society, Washington.

Feb. 28.—T. C. Mendenhall, Exhibition and Description of New Pendulum Apparatus; A. C. True, The Status and Tendencies of the Agricultural Experiment Stations; George P. Merrill, The World's Nickel-Supply; Edward Goodfellow, Biographical Notice of the Late Capt. C. O. Boutelle.

New York Academy of Sciences.

March 2.—J. K. Rees, Remarks on the Reduction of Rutherford Star Plates; H. Jacoby, On the Calculation of Star Places for Zenith Telescope Observations; John Tatlock, Jun., An Index to Copernicus, an International Journal of Astronomy.

Natural Science Association of Staten Island.

Feb. 14.—L. P. Gratacap, The Turbid water of the Staten Island Water-Supply Company; W. T. Davis showed specimens of Linden-trees (Tilia Americana), and read a memorandum in connection with them; Mr. Davis also contributed entomological notes; Mrs. N. L. Britton, Barbula papillosa, Muell., as an Addition to the List of Staten Island Mosses published last July; Dr. N. L. Britton showed leaves of silver-maple infested by a black fungoid growth, which was determined by Mr. J. B. Ellis to be *Rhytisma acerinum* (Pers.)Fr.; Joseph C. Thompson noted the capture, last December, of *Hydrocanthus irricolor* and *Hydrophilus nimbatus* in a pond, under four inches of ice; a piece of Helderberg limestone, collected by Mr. Arthur Hollick from the drift on Fort Hill, was shown by Mr. Gratacap.

Boston Society of Natural History.

March 4.—W. M. Davis, Illustration of the Faulted Monoclinal Structure and Topographic Development of the Triassic Formation of Connecticut by a Working Model; N. S. Shaler, Antiquity of the Glacial Period.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

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WANTED.—A young man who has been teaching in a first-class High School desires a position in a similar institution. Is competent to teach Mathematics, Latin, Book-keeping, and the English branches. Can give highest references Address H. W. MARTHENS, 6208 Broad St., Pittsburgh, Pa.

WANTED.—A situation in a scientific house by a graduate of the scientific department of the Jersey City High School as Geologist, Mineralogist or as assistant teacher in Physics or assistant to a chemist. Best of references. E. W. PERRY, 582 Third Street, Jersey City, N. J.

WANTED.—By a medical student of three courses, a position on some war or mercantile vessel sailing between America and some foreign country, as Clerk, Assistant Physician or Druggist, or any respectable occupation. Content with a moderate remuneration. Highest commendations. W. L. S., *Science* Office.

INFORMATION WANTED.—Clarence W. Bowen, Secretary of the Committee on the Centennial of Washington's Inauguration, 251 Broadway, New York, desires information regarding the portraits of John Hathorn and Jeremiah Van Rensselaer, members of Congress from New York. These portraits, for the Memorial Volume, are particularly desired, to complete the list of portraits of the New York delegation in Congress at the time of Washington's inauguration.

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WANTED.—An Entomologist to accompany a camping party of boys during July next. Address, stating experience and salary expected, ALBERT L. AREY, Free Academy, Rochester, N.Y.

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I have a good supply of Eastern Coleoptera which I wish to exchange for species not in my collection. Melandryidae and Oedemeridae especially desired. Joe C. Thompson, Rosebank P. O., Box 73, S. I.

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1890 Seeger and Guernsey Cyclopedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost $6. David R. Lewis, Saybrook, Ill.

SCIENCE

NEW YORK, MARCH 6, 1891.

LIGHTNING-ROD PROTECTION.

What is the Problem?

IN seeking a means of protection from lightning-discharges, we have in view two objects,—the one the prevention of damage to buildings, and the other the prevention of injury to life. In order to destroy a building in whole or in part, it is necessary that work should be done; that is, as physicists express it, energy is required. Just before the lightning-discharge takes place, the energy capable of doing the damage which we seek to prevent exists in the column of air extending from the cloud to the earth in some form that makes it capable of appearing as what we call electricity. We will therefore call it electrical energy. What this electrical energy is, it is not necessary for us to consider in this place; but that it exists there can be no doubt, as it manifests itself in the destruction of buildings. The problem that we have to deal with, therefore, is the conversion of this energy into some other form, and the accomplishment of this in such a way as shall result in the least injury to property and life.

Why have the Old Rods Failed?

When lightning-rods were first produced, the science of energetics was entirely undeveloped; that is to say, in the middle of the last century scientific men had not come to recognize the fact that the different forms of energy — heat, electricity, mechanical power, etc.— were convertible one into the other, and that each could produce just so much of each of the other forms, and no more. The doctrine of the conservation and correlation of energy was first clearly worked out in the early part of this century. There were, however, some facts known in regard to electricity a hundred and forty years ago; and among these were the attracting power of points for an electric spark, and the conducting power of metals. Lightning-rods were therefore introduced with the idea that the electricity existing in the lightning-discharge could be conveyed around the building which it was proposed to protect, and that the building would thus be saved.

The question as to dissipation of the energy involved was entirely ignored, naturally; and from that time to this, in spite of the best endeavors of those interested, lightning-rods constructed in accordance with Franklin's principle have not furnished satisfactory protection. The reason for this is apparent when it is considered that this electrical energy existing in the atmosphere before the discharge, or, more exactly, in the column of dielectric from the cloud to the earth, above referred to, reaches its maximum value on the surface of the conductors that chance to be within the column of dielectric; so that the greatest display of energy will be on the surface of the very lightning-rods that were meant to protect, and damage results, as so often proves to be the case.

It will be understood, of course, that this display of energy on the surface of the old lightning-rods is aided by their being more or less insulated from the earth, but in any event the very existence of such a mass of metal as an old lightning-rod can only tend to produce a disastrous dissipation of electrical energy upon its surface,— "to draw the lightning," as it is so commonly put.

Is there a Better Means of Protection?

Having cleared our minds, therefore, of any idea of conducting electricity, and keeping clearly in view the fact that in providing protection against lightning we must furnish some means by which the electrical energy may be harmlessly dissipated, the question arises, "Can an improved form be given to the rod, so that it shall aid in this dissipation?"

As the electrical energy involved manifests itself on the surface of conductors, the improved rod should be metallic; but, instead of making a large rod, suppose that we make it comparatively small in size, so that the total amount of metal running from the top of the house to some point a little below the foundations shall not exceed one pound. Suppose, again, that we introduce numerous insulating joints in this rod. We shall then have a rod that experience shows will be readily destroyed — will be readily dissipated — when a discharge takes place; and it will be evident, that, so far as the electrical energy is consumed in doing this, there will be the less to do other damage.

The only point that remains to be proved as to the utility of such a rod is to show that the dissipation of such a conductor does not tend to injure other bodies in its immediate vicinity. On this point I can only say that I have found no case where such a conductor (for instance, a small wire or gilding) has been dissipated, even if resting against a plastered wall, where there has been any material damage done to surrounding objects.

Of course, it is readily understood that such an explosion cannot take place in a confined space without the rupture of the walls (the wire cannot be boarded over); but in every case that I have found recorded this dissipation takes place just as gunpowder burns when spread out on a board. The objects against which the conductor rests may be stained, but they are not shattered.

I would therefore make clear this distinction between the action of electrical energy when dissipated on the surface of a large conductor and when dissipated on the surface of a comparatively small or easily dissipated conductor. When dissipated on the surface of a large conductor, — a conductor so strong as to resist the explosive effect, — damage results to objects around. When dissipated on the surface of a small conductor, the conductor goes, but the other objects around are saved.

A Typical Case of the Action of a Small Conductor.

Franklin, in a letter to Collinson read before the Royal Society, Dec. 18, 1755, describing the partial destruction by lightning of a church-tower at Newbury, Mass., wrote, "Near the bell was fixed an iron hammer to strike the hours; and from the tail of the hammer a wire went down through a small gimlet-hole in the floor that the bell stood upon, and through a second floor in like manner; then hori-

zontally under and near the plastered ceiling of that second floor, till it came near a plastered wall; then down by the side of that wall to a clock, which stood about twenty feet below the bell. The wire was not bigger than a common knitting needle. The spire was split all to pieces by the lightning, and the parts flung in all directions over the square in which the church stood, so that nothing remained above the bell. The lightning passed between the hammer and the clock in the above mentioned wire, without hurting either of the floors, or having any effect upon them (except making the gimlet-holes, through which the wire passed, a little bigger), and without hurting the plastered wall, or any part of the building, so far as the aforesaid wire and the pendulum-wire of the clock extended; which latter wire was about the thickness of a goose-quill. From the end of the pendulum, down quite to the ground, the building was exceedingly rent and damaged. . . . No part of the aforementioned long, small wire, between the clock and the hammer, could be found, except about two inches that hung to the tail of the hammer, and about as much that was fastened to the clock; the rest being exploded, and its particles dissipated in smoke and air, as gunpowder is by common fire, and had only left a black smutty track on the plastering, three or four inches broad, darkest in the middle, and fainter towards the edges, all along the ceiling, under which it passed, and down the wall."

Mathematical Theory.

There is stored up in each cubic centimetre of the column of dielectric from the cloud to the earth, just before the lightning-discharge, an amount of electrical energy given by the expression $\frac{1}{8\pi} KE^2$. where K is the specific inductive capacity of the dielectric air, and E the electro-motive intensity, both in electrostatic units. This expression is given on p. 156, Vol. I., second edition, of Maxwell's "Treatise on Electricity and Magnetism." Substituting the values of K and E (remembering, of course, that they are in electrostatic units), and reducing, we find that the amount of energy involved amounts very nearly to one foot-pound for each cubic foot of air involved. If we consider that the dissipation of this electrical energy takes place throughout the whole length of the column of dielectric from the cloud to the earth, we shall see that all the energy that we have to care for in our lightning-rod is that existing in the section of the column contained between two horizontal planes passing through the top and foundation of our house respectively. This may not, of course, be strictly true, but it must be essentially.

No reason can be assigned why the electrical energy should disappear at the top, or at the bottom, or at the centre, of the column of dielectric in which it exists, so that it is reasonable to maintain that what we call a lightning-flash is simply a line of air in which the electrical energy is being dissipated as heat. The energy, therefore, is transmitted, not from the cloud to the earth or from the earth to the cloud, but horizontally from all portions of the dielectric to some central core where it appears as heat, and where the phenomenon we call a lightning-flash is manifested.

One result of this consideration is, that, in order to produce the amount of energy which is known to exist in lightning-discharges, the radius of the column of dielectric at the surface of the earth must be very considerable, in order that there shall be a sufficient mass of air to furnish, at the rate of one foot-pound per cubic foot, enough energy to produce the well-known results. N. D. C. HODGES.

ARISTOTLE AS A NATURALIST.[1]

HAVING had occasion of late years to make myself acquainted with the observations and ideas of ancient writers upon matters connected with natural history, and having been thus more than ever impressed by the unique position which in this respect is held by Aristotle, it appears to me that a short essay upon the subject may prove of interest to readers of various kinds. Therefore, as far as space permits, I will render the results of my own inquiries in this direction; but, as it is far from an easy task to estimate with justice the scientific claims of so pre-scientific a writer, I shall be greatly obliged to more professed students of Aristotle if they will indicate, either publicly or privately, any errors of fact or of judgment into which it may appear that I have fallen.

Aristotle died B.C. 322, in the sixty-third year of his age. As a personal friend and devoted pupil of Plato, — who, in turn, was a friend and pupil of Socrates, — his mind was at an early age brought under the immediate influence of the best thinking of antiquity. Nevertheless, although entertaining a profound veneration for his master, like a true devotee of truth, he did not allow his mind to become unduly dominated even by the authority of so august a tutor; and in after-life he expressly broke away from the more mystical principles of Platonic method. While still a young man, he was invested with the magnificent office of educating Alexander the Great. He held this position for a period of four years, and then the young prince, at the age of eighteen, became regent. It is interesting to note that the relations which subsisted between this greatest philosopher and this greatest general in the world's history were throughout relations of warmest friendship. Indeed, had it not been for the munificent aid which was afterwards given by Alexander, it would have been impossible for Aristotle to have prosecuted the work which he accomplished.

Questions have been raised, not only as to the authenticity of this work, but also as to the originality of much that is undoubtedly authentic. Into these questions, however, I need not go. Whether or not Aristotle borrowed from other writers without acknowledgment, it is certain that in his writings alone are preserved the records of early biological thought and observation, which would otherwise have been lost; and the preservation of these records is of more importance for our present purpose than is the question to whom such thought and observation were in every case due.

Whether we look to its width or to its depth, we must alike conclude that the range of Aristotle's work is wholly without a parallel in the history of mankind. Indeed, it may be said that there is scarcely any one department of intellectual activity where the mind of this intellectual giant has not exerted more or less influence, in some cases by way of creation, in others by way of direction. The following is a list of the subjects on which Aristotle wrote: physics, astronomy, meteorology, zoölogy, comparative anatomy, physiology, and psychology; poetry, ethics, rhetoric, logic, politics, and metaphysics. Of these subjects he was most successful in his treatment of the second series as I have arranged them, or of the more abstract and least rigidly scientific. In his "Politics" he gave the outlines of two hundred and twenty-five constitutions, and, although but a fragment of his whole work in this direction has come down to us, it is still regarded as one of the best treatises that has ever been written on the subject. His "Ethics," "Rhetoric," and "Logic," also, still present much more than a merely historical interest, for he may be said to have correctly laid down the fundamental principles of these sciences, his analysis of the syllogism, in particular, having left but comparatively little for subsequent logicians to complete; and, lastly, his "Metaphysics" alone would have been sufficient to have placed him among the greatest thinkers of antiquity.

That his labors in the field of more exact science should not now present a comparable degree of value, is, of course, inevitable. At the time when he wrote, the very methods of exact science were unknown; and I think it constitutes the strongest of all his many claims to our intellectual veneration that he was able to perceive so largely as he did the superior value of the objective over the subjective methods in matters pertaining to natural sci-

[1] From The Contemporary Review.

ence. When we remember how inveterate and how universal is the bondage of all early thought to the subjective methods; when we remember, that, for the best part of twenty centuries after the birth of Aristotle, the intellect of Europe was still held fast in the chains of that bondage; and when we remember that even at the present time, with all the advantages of a long and painful experience, we find it so extremely difficult to escape it, — when we remember these things, we can only marvel at the scientific instinct of this man who, although nurtured in the school of Plato, was able to see — darkly, it may be, and, as it were, in the glass of future things, but still was able to see — that the true method of science is the method of observation and experiment. "Men who desire to learn," he said, "must first learn to doubt, for science is only the solution of doubts;" and it is not possible more concisely to state the intellectual duty of scepticism, or the paramount necessity of proof, which thousands of years of wasted toil have now enabled all intelligent men more or less to realize.

Nevertheless, as I have said, the vision of scientific method which Aristotle had was a vision of that which is only seen in part: the image of the great truth which he perceived was largely distorted by passing through the medium of pre-existing thought. Consequently, of late years a great deal of discussion has taken place on the subject of Aristotle's method. On the one hand, it is maintained that he is entitled to the place which is usually assigned to Bacon as the father of the inductive methods; while, on the other hand, it is maintained that in respect of method he did not make any considerable advance upon his predecessors. In my opinion, a just estimate lies between these two extremes. Take, for example, the following passages from his writings: —

"We must not accept a general principle from logic only, but must prove its application to each fact, for it is in facts that we must seek general principles, and these must always accord with facts."

"The reason why men do not sufficiently attend to the facts is their want of experience. Hence those accustomed to physical inquiry are more competent to lay down the principles which have an extensive application; whereas others who have been accustomed to many assumptions without the apposition of reality, easily lay down principles because they take few things into consideration. It is not difficult to distinguish between those who argue from facts and those who argue from notions."

Many similar passages to the same effect might be quoted, and it is evident that the true method of inductive research could not well have its leading principles more clearly enunciated; and to say this much is in itself enough to place Aristotle in the foremost rank among the scientific intellects of the world. But it would be unreasonable to expect that this great herald of scientific method should have been able, with any powers of intellect, to have entirely emancipated himself from the whole system of previous thought; or in the course of a single lifetime to have fully learned the great lesson of method which has only been taught by the best experience of more than twenty centuries after his death. Accordingly, we find that, although he clearly divined the true principles of research, he not unfrequently fell short in his application of those principles to practice. In particular, he had no adequate idea of the importance of verifying each step of a research, or each statement of an exposition; and therefore it is painfully often that his own words just quoted admit of being turned against himself, — "It is easy to distinguish between those who argue from facts and those who argue from notions." To give only a single example, he says that if a woman who has scarlet-fever looks at herself in a mirror, the mirror will become suffused with a bloody mist, which, if the mirror be new, can only be rubbed off with difficulty. Now, instead of proceeding to verify this old wife's tale, he attempts to explain the alleged fact by a rambling assemblage of absurd "notions." And numerous other instances might be given to the same effect. Nevertheless, upon the whole, or as a general rule, in his thought and language, in his mode of conceiving and grappling with problems of a scientific kind, in the importance which he assigns to the smallest facts, and in the general cast of reasoning which he employs, Aristotle resembles, much more closely than any other philosopher of like antiquity, a scientific investigator of the present day.

Thus, in seeking to form a just estimate of Aristotle's work in natural history, we must be careful, on the one hand, to avoid the extravagant praise which has been lavished upon him, even by such authorities as Cuvier, De Blainville, Isidore St. Hilaire, etc.; and, on the other hand, we must no less carefully avoid the unfairness of contrasting his working methods with those which have now become habitual.

In proceeding to consider the extraordinary labors of this extraordinary man, in so far as they were concerned with natural history, I may begin by enumerating, but without waiting to name, the species of animals with which we know that he was acquainted. From his works on natural history, then, we find that he mentions at least 70 species of mammals, 150 of birds, 20 of reptiles, 116 of fish, 84 of articulata, and about 40 of lower forms, making close upon 500 species in all. That he was accustomed from his earliest boyhood to the anatomical study of animal forms, we may infer from the fact of his father having been a physician of eminence, and an Asclepiad; for, according to Galen, it was the custom of the Asclepiads to constitute dissection part of the education of their children. Therefore, as Aristotle's boyhood was passed upon the seacoast, it is probable that from a very early age his studies were directed to the anatomy and physiology of marine animals. But, of course, it must not be concluded from this that the dissections then practised were comparable with what we understand by dissections at the present time. We find abundant evidence in the writings of Aristotle himself that the only kind of anatomy then studied was anatomy of the grosser kind, or such as might be prosecuted with a carving-knife as distinguished from a scalpel.

We generally hear it said that as a naturalist Aristotle was a teleologist, or a believer in the doctrine of design as manifested in living things: therefore I should like to begin by making it clear how far this statement is true; for, unquestionably, when such an intellect as that of Aristotle is at work upon this important question, it behooves us to consider exactly what it was that he concluded.

Now, I do not dispute — indeed, it would be quite impossible to do so — that Aristotle was a teleologist, in the sense of being in every case antecedently convinced that organic structures are adapted to the performance of definite functions, and that the organism as a whole is adapted to the conditions of its existence. Thus, for example, he very clearly says, "As every instrument subserves some particular end, that is to say, some special function, so the whole body must be destined to minister to some plenary sphere of action; just as the saw is made for sawing, — this being its function, — and not sawing for the saw."

But in any other sense than this of recognizing adaptation in Nature, I do not think there is evidence of Aristotle having been a teleologist. In his "Metaphysics" he asks the question whether the principle of order and excellence in Nature is a self-existing principle inherent from all eternity in Nature herself; or whether it is like the discipline of an army, apparently inherent, but really due to a general in the background. Aristotle, I say, asks this question; but he gives no answer. Similarly, in his "Natural History," he simply takes the facts of order and adaptation as facts of observation: and therefore in biology I do not think that Aristotle can be justly credited with teleology in any other sense than a modern Darwinist can be so credited; that is to say, he is a believer in adaptation, or final end, but leaves in abeyance the question of design, or final cause. The only respect in which he differs from a modern Darwinist, although even here the school of Wallace and Weismann agree with him, is in holding that adaptation must be present in all cases, even where the adaptation is not apparent. In the case of rudimentary organs, he is puzzled to account for structures apparently aimless, and therefore he invents what we may term an imaginary aim by saying that Nature has supplied these structures as "tokens," whereby to sustain her unity of plan. This idea was prominently revived in modern pre-Darwinian times; but in the present connection it is enough to observe that here, as elsewhere, Aristotle personifies Nature as a designing or contriving agency, having the attainment of order

and harmony as the final end or aim of all her work. He appears, however, clearly to have recognized, that, so far at least as science is concerned, such personification is, as it were, allegorical; for he expressly says that if he were asked whether Nature works out her designs with any such conscious deliberation, or intentional adjustment of means to ends, as is the case with a builder or a shipwright, he would not be able to answer. All, therefore, that the teleology of Aristotle amounted to was this: he found that the hypothesis of purpose was a useful working hypothesis in his biological researches. There is nothing to show that he would have followed the natural theologians of modern times, who seek to rear upon this working hypothesis a constructive argument in favor of design. On the other hand, it is certain that he would have differed from these theologians in one important particular; for he everywhere regards the purposes of Nature as operating under limitations imposed by what he calls absolute necessity. Monsters, for example, he says are not the intentional work of Nature herself, but instances of the victory of matter over Nature; that is to say, they are instances where Nature has failed to satisfy those conditions of necessity under which she acts. Thus, even if there be a disposing mind which is the author of Nature, according to Aristotle it is not the mind of a creator, but rather that of an architect, who does the best he can with the materials supplied to him, and under the conditions imposed by necessity.

Turning, now, to the actual work which Aristotle accomplished in the domain of biology, I will first enumerate his more important discoveries upon matters of fact, and then proceed to mention his more important achievements in the way of generalization.

He correctly viewed the blood as the medium of general nutrition, and knew that for this purpose it moved through the blood-vessels from the heart to all parts of the body, although he did not know that it returned again to the heart, and thus was ignorant of what we now call the circulation. But he was the first to find that the heart is related to the blood-vascular system; and this he did by proving, in the way of dissection, that its cavities are continuous with those of the large veins and arteries. Nor did he end here. He traced the course of these large veins and arteries, giving an accurate account of their branchings and distribution. He knew perfectly well that arteries contain blood; and this is a matter of some importance, because it has been the habit of historians of physiology to affirm that all the ancients supposed arteries to contain air. In speaking of the cavities of the heart, he appears to have fallen into the unaccountably foolish blunder of saying that no animal has more than three, and that some animals have as few as one. But, although this apparent error has been harped upon by his critics, it is clearly no error at all. Professor Huxley has shown that what Aristotle here did was to regard the right auricle as a venous sinus, or as a part of the great vein, and not of the heart. The only mistake of any importance that he made in all his researches upon the anatomy of the heart and blood-vessels, was in supposing that the number of cavities of the heart is in some measure determined by the size of the animal. Here he undoubtedly lays himself open to the charge of basing a general and erroneous statement on a preconceived idea, without taking the trouble to test it by observation. But we may forgive him this little exhibition of negligence when we find that it was committed by the same observer, who correctly informs us that the heart of the chick is first observable as a pulsating point on the third day of incubation, or who graphically tells us that just as irrigating trenches in gardens are constructed to distribute water from one single source through numerous channels, which divide and subdivide so as to convey it to all parts, and thus to nourish the garden-plants which grow at the expense of the water, so the blood-vessels start from the heart in a ramifying system, in order to conduct the nutritive fluid to all regions of the body. Lastly, Aristotle experimented on coagulation of the blood, and obtained accurate results as to the comparative rates with which the process takes place in the blood of different animals. He also correctly described the phenomenon as due to the formation of a meshwork of fibres, but he appears to have erroneously supposed that these fibres exist in the blood before it is drawn from the body.

So much, then, for his views upon the heart, the blood, and the blood-vessels. He was less fortunate in his teaching about the bladder, kidneys, liver, spleen, and so forth, because he had no sufficient physiological data to go upon. Still, one would think he might have avoided the error of attributing the formation of urine to the bladder, seeing that he had gone so far as to perceive that the kidneys separate out the urine, which, as he correctly says, then flows into the bladder. His chapters on the digestive tract display a surprisingly extensive and detailed investigation of the alimentary systems of many animals, and the observations made are for the most part accurate. In particular, his descriptions of the teeth, œsophagus, epiglottis, and the mechanism of deglutition, display so surprising an amount of careful and detailed observation throughout the vertebrated series, that they read much like a modern treatise upon these branches of comparative anatomy. The same remark applies to his disquisition on horns. Where inaccurate, his mistakes here are mostly due to his ignorance of exotic forms.

Adipose tissue he correctly viewed as excess of nutritive matter extracted from the blood, and he noted that fatness is inimical to propagation. Marrow he likewise correctly regarded as having to do with the nutrition of bones, and observed that in the embryo it consists of a vascular pulp.

That Aristotle should have had no glimmering notion either of the nervous system or of its functions, is, of course, not surprising; but to me it is surprising that so acute an observer should have failed to perceive the physiological meaning of muscles. Although he knew that they are attached to bones, that they occur in greatest bulk where most strength of movement is required,— such as in the arms and legs of man, the breasts of birds, and so forth,— and although he must have observed that the muscles swell and harden when the limbs move, yet it never occurred to him to connect muscles with the phenomena of movement. He regarded them only as padding, having also in some way to do with the phenomena of sensation. Thus we appear to have one of those curious instances of feeble observation with which every now and then he takes us by surprise. To give parenthetically a still more strange example of what I mean, one would think that there is nothing in the economy of a star-fish or an echinus more conspicuous, or more calculated to arrest attention, than the ambulacral system of tube feet; yet Aristotle, while describing many other parts of those animals, is quite silent about this ambulacral system. I think this fact can only be explained by supposing that he confined his observations to dead specimens; but, as he was not an inland naturalist, even this explanation does not acquit him of a charge of negligence, which, when contrasted with his customary diligence, appears to me extraordinary.

His ignorance of the nervous system led him to a variety of speculative errors. In particular, he was induced to regard the heart as the seat of mind, and the brain as a bloodless organ, whose function it was to cool the heart, which he supposed to be not only the organ of mind, but also an apparatus for cooking the blood, and by it the food. The respiratory system was also conceived by him as a supplementary apparatus for the purpose of keeping the body cool,— a curious illustration of early philosophical thought arriving at a conclusion which, to use his own terminology, was directly opposed to the truth. Nevertheless, the reasoning which landed him in this erroneous conclusion was not only perfectly sound, but also based upon a large induction from facts, the observation of which is highly creditable. The reason why he supposed the office of respiration to be that of cooling the body was because nearly all animals which respire by means of lungs exhibit a high temperature; and, imagining that temperature or "vital heat" was a property of the living soul, his inference was inevitable that the function of the lungs was that of keeping down the temperature of warm-blooded animals. Here, then, his error was due to deficiency of information, and the same has to be said of the great majority of his other errors. For instance, with regard to the one already mentioned about the heart being the seat of mind, this is usually said by commentators to have been due merely to the accident of the heart occupying a central position; and no doubt such was partly his reason, for he

considered that position the noblest, and repeatedly argues that on this account it must be the seat of mind. But over and above this mystical, not to say childish, reason, I think he must have had another: for, seeing that the error is a very general one in early philosophical thought,— we find it running through the Psalms, and it is still conventionally retained by all poetic writers,— I think we must look for some more evident reason than that of mere position to account for it; and this reason I take to be the perceptible influence on the heart-beat which is caused by emotions of various kinds. Furthermore, Aristotle expressly assigns the following as another of his reasons: "In the embryo the heart appears in motion before all other parts, as if it were a living animal, and as if it were the beginning of all animals that have blood."

Turning, now, for a moment to Aristotle's still more detailed discoveries in comparative anatomy and physiology, his most remarkable researches are, I think, those on the *Cetacea*, *Crustacea*, and *Oephalopoda*. Here the amount of minute and accurate observation which he displayed is truly astonishing, and in some cases his statements on important matters of fact have only been verified in our own century; such, for instance, as the peculiar mode of propagation which has now been re-discovered in some of the *Cephalopoda*.[1] He also knew the anomalous fact that in these animals the vitellus is joined to the mouth of the embryo; that in certain species of cartilaginous fish the embryo is attached to its parent by the intervention of a placenta-like structure; and, in short, detailed so many anatomical discoveries, both as regards the vertebrata and invertebrata, that a separate article would be required to make them intelligible to a general reader. In this connection, therefore, I will only again insist upon the enormous difference between Aristotle and the great majority of his illustrious countrymen in respect of method. Unless it can be shown that an ancient writer has been led to anticipate the results of modern discovery by the legitimate use of inductive methods, he deserves no more credit for his guesses when they happen to have been right than he does when they happen to have been wrong. This, however, is a consideration which we are apt to neglect. When we find that an old philosopher has made a statement which science has afterwards shown to be true, we are apt to regard the fact as proof of remarkable scientific insight; whereas, when we investigate the reasonings which led him to propound the statement, we usually find that they are of a puerile nature, and only happened to hit the truth, as it were, by accident. Among a number of guesses made at random and in ignorance, a certain percentage may well prove right; but, under these circumstances, the man who happens to make a correct guess deserves no more credit than he who happens to have made an erroneous one. Indeed, he may deserve even less credit. For instance: when the Pythagoreans, on a basis of various mystical and erroneous speculations, propounded a kind of dim adumbration of the heliocentric theory, far from deserving any credit for superior sagacity at the hands of modern science, they merit condemnation for their extravagant theorizing and unguarded belief. In their time, whatever evidence there was lay on the side of the then prevalent view that the sun moves round the earth: therefore, when, without adducing any counter evidence of a scientific kind, they affirmed that the earth moved round the sun, they were merely displaying the spirit of what the Yankees call "pure cussedness;" that is to say, they were shutting their eyes to the only evidence which was available, and showing their own obstinacy by propounding a directly opposite view. The sound maxim in science is, that he discovers who proves; and this is a maxim which many classical scholars would do well to remember when writing about the scientific speculations of the early Greeks.

Now, I have made these remarks in order again to emphasize the almost unique position which Aristotle holds among his contemporaries in this respect. Instead of giving his fancy free rein upon "the high *priori* road," he patiently plods the way of detailed research; and, when he proceeds to generalize, he does so as far as possible upon the basis of his inductive experience.

[1] Lewes, however, denies that the evidence is sufficient to show that Aristotle knew this.

Coming, now, to his generalizations, it was a true philosophical insight which enabled Aristotle to perceive in organic nature an ascending complexity of organization from the vegetable kingdom up to man. Instead of the three kingdoms of Nature, which were afterwards formulated by the alchemists, and which in general parlance we still continue to preserve, namely, the mineral, vegetable, and animal — instead of these three kingdoms, Aristotle adopted the much more philosophical classification of Nature into two divisions, the organic and the inorganic, or the living and the not-living. Nevertheless he fell into the error — which was, indeed, almost unavoidable in his time — of supposing that there is a natural and a daily passage of the one into the other. However, he again shows his philosophical insight where he points out the leading distinctions between plants and animals, the former manifesting life in the phenomena of nutrition alone, including germination, growth, repair, and reproduction; while the latter, besides these, exhibit also the phenomena of sensation, volition, and spontaneous movement. He was not so fortunate in his attempts at drawing the boundary-lines between plants and animals: for while he correctly guessed, from erroneous observation, that sponges should be classified as animals, he decided in favor of placing the hydroid polyps among the plants; and he appears to have classified certain testaceous mollusks in the same category. Man, of course, he places at the head of the animal kingdom, and shows a profound penetration in drawing the true psychological distinction between him and the lower animals; namely, that animals only know particular truths, never generalize, or form abstract ideas

His conception of life was more in accordance with that of modern science than that of any of the other conceptions which have been formed of it either in ancient times or the middle ages, for he seems clearly to have perceived the error of regarding the "vital principle" otherwise than as an abstraction of our own making. Life and mind, in his view, were abstractions pertaining to organisms, just in the same way as weight and heat are abstractions pertaining to inanimate objects. For convenience of expression, or even for purposes of research, it may be desirable to speak of weight and heat as independent entities: but we know that they cannot exist apart from material objects; that they are what we term qualities, and not themselves objects. And so with life and mind: they are regarded by Aristotle as qualities — or, as we should now say, functions — of organisms. And here we must remember that the whole course of previous speculation on such matters proceeded on the assumption that the vital principle was an independent entity superadded to organisms, serving to animate them as long as it was united to them, leaving them to death and decay as soon as it was withdrawn from them, and even then being itself able to survive as a disembodied spirit, enjoying its conscious existence apart from all material conditions. Thus it was that the creations of early thought peopled the world with ghosts and spirits more numerously than Nature had supplied it with living organisms. Now, Aristotle boldly broke away from this fundamental assumption of the vital principle as an independent and superadded entity. In the phenomena of life and mind he saw merely the functions of organism: he assigned to them both a physical basis, and clearly perceived that for any fruitful study of either we must have recourse to the methods of physiology.

The scientific genius which could have enabled a man in those days thus to have anticipated the temper of modern thought, appears to me entitled to our highest veneration. Here, perhaps more than anywhere else, he showed his instinctive appreciation of the objective methods; and here it is that the longest time has been taken for mankind to awaken to the truth of his appreciation.

In subsequent centuries, when European thought drifted away from science into theology, the question was long and warmly debated whether or not Aristotle believed in the immortality of the soul. The truth of the matter is that his deliverances upon this question are more scarce than clear. The following brief passage, however, appears to show that he regarded the thinking principle, as distinguished from the animal soul, to be virtually independent of the corporeal organization: "Only the intellect

enters from without. It alone is god-like. Its actuality has nothing in common with the corporeal actuality."

Aristotle appears to have been the first philosopher who at all appreciated the importance of heredity as a principle, not only in natural history, but also in psychology; for he distinctly affirms that the children of civilized communities are capable of a higher degree of intellectual cultivation than are children of savages.

Among his other more noteworthy enunciations of general truths, we may notice the following: —

"The advantage of physiological division of labor was first set forth," says Milne-Edwards, "by myself in 1827." Yet Aristotle had said repeatedly that it is preferable, when possible, to have a separate organ for a separate office; and that Nature never, if she can help it, makes one organ answer two purposes, as a cheap artist makes "spit and candlestick in one."

Again, that the complexity of life varies with the complexity of organization; that the structural differences of the alimentary organs are correlated with differences of the animal's alimentation; that no animal without lungs has a voice, and that no animal is endowed with more than one adequate means of defence; that there is an inverse relation between the development of horns and of teeth, as also between growth and generation; that no dipterous insect has a sting; that the embryo is evolved by a succession of gradual changes from a homogeneous mass into a complete organism; that the development of an organism is a progress from a general to a special form,— these and numerous others are instances of generalization made by Aristotle, which have lasted, with but slight modifications of his terms, to the present day.[1]

Of these generalizations the most remarkable is the last which I have mentioned; for one of the greatest and most momentous controversies which the history of science has afforded is that which took place nearly 2000 years after the time of Aristotle, with regard to so-called evolution *versus* epigenesis. The question was whether the germ or egg of any organism contained the future or young organism already formed in miniature, and only requiring to be expanded in order to appear as the perfect organism, or whether the process of development consisted in a progress from the indefinite to the definite, from the simple to the complex, from what we call undifferentiated protoplasm to the fully differentiated animal. During the seventeenth and eighteenth centuries, when this subject was most warmly debated, the balance of scientific opinion inclined to what is now known to be the erroneous view, that germ is merely the adult organism in miniature. It therefore speaks greatly in favor of Aristotle's sagacity that he clearly and repeatedly expressed the opinion which is now known to be right; viz., that the organism develops out of its germ by a series of differentiations. And not only with reference to this doctrine of epigenesis, but likewise throughout the whole course of his elaborate treatise on generation, he displays such wonderful powers, both of patient observation and accurate scientific reasoning, that this treatise deserves to be regarded as the most remarkable of all his remarkable works pertaining to biology. The subject-matter of it is not, however, suited to any detailed consideration within the limits imposed by an article; and therefore I will merely back the general opinion which I have just given by quoting that of the most severe and exacting of all Aristotle's critics from the side of science,— severe and exacting, indeed, to a degree which is frequently unjust. I mean the late George Henry Lewes. This is what he says of the treatise on generation: —

"It is an extraordinary production. No ancient and few modern works equal it in comprehensiveness of detail and profound speculative insight. We there find some of the obscurest problems of biology treated with a mastery which, when we consider the condition of science at that day, is truly astonishing. . . . I know no better eulogy to pass on Aristotle than to compare his work with the 'Exercitations concerning Generation' of our immortal Harvey. The founder of modern physiology was a man of keen insight, of patient research, of eminently scientific mind. His work is superior to that of Aristotle in some few anatomical details; but it is so inferior to it in philosophy, that at the present day it is much more antiquated, much less accordant with our views."

[1] Dr. W. Ogle, in his admirable work on Aristotle, has already alluded to these and some of the other points previously noticed.

I have now said enough to convey a general idea of the enormous range of Aristotle's work within the four corners of biology, his amazing instincts of scientific method, and his immense power of grasping generalizations. While doing this, I have selected instances of his accuracy rather than of his inaccuracy, not only because it is in the former that he stands in most conspicuous contrast with all preceding and with most succeeding philosophers of antiquity, but also because it is here that we may be most sure of according justice. Where we meet with statements of fact which are accurate, we may be satisfied that we are in immediate contact with the mind of Aristotle himself; but when we meet with inaccurate statements, we must not be so sure of this. Not only is it probable that in the great majority of these cases he has been misled by erroneous information supplied to him by travellers, fishermen, and others, but there is good reason to suppose that in some places his manuscripts may have been tampered with. These were hidden underground for the better part of two centuries; and when they were eventually brought to light, Apellicon, into whose hands they fell, "felt no scruples in correcting what had been worm-eaten, and supplying what was defective or illegible."[1]

Thus, to quote Dr. Ogle, who suggests the view here taken: "Is it possible to believe that the same eye that has distinguished the cetacea from the fishes, that had detected their hidden mammæ, discovered their lungs, and recognized the distinct character of their bones, should have been so blind as to fancy that the mouth of these animals was on the under surface of the body?" And so on with other cases.

Inaccuracies of observation, however, there must have been; and there must have been inaccuracies of reasoning. Looking to the enormous range of his work in biology alone, remembering that in this work he had had no predecessors, considering that at the same time he was thus a single-handed collector of facts and a single-minded thinker upon their import, it becomes evident that Aristotle would have been something more than human if either his observations or his reasonings could everywhere be justly compared with those of scientific genius when more favorably circumstanced. But it is the glory of Aristotle that both his observations and his reasonings can stand such comparison as well as they do: for when on the one hand we remember the immensity of his achievement, and on the other hand reflect that he was worse than destitute of any ancestral experience of method, born into a world of mysticism, nurtured in the school of Plato, therefore compelled himself to forge the intellectual instruments of research, himself to create the very conception of scientific inquiry,— when we thus remember and thus reflect, it appears to me there can be no question that Aristotle stands forth, not only as the greatest figure of antiquity, but as the greatest intellect that has ever appeared upon the face of this earth.

The overmastering power with which this intellect swayed the course of subsequent thought was in one respect highly beneficial to the interests of science, but in another respect it was no less deleterious. It was beneficial in so far as it revealed to mankind the true method of science as objective, and not subjective: it was deleterious, inasmuch as the very magnitude of its force reduced the intellect of Europe for centuries afterwards to a condition of abject slavery. Nothing is more deleterious to the interests of science than undue regard to authority. Before all else the spirit of Science must be free: it must be unfettered by the chains of prejudice, whether these be forged by our own minds or manufactured for us by the minds of others. Her only allegiance is that which she owes to Nature, to man she owes nothing; and here, as elsewhere, it is impossible to serve two masters. Therefore, the only use of authority in science is to furnish men of less ability with suggestions which, as suggestions, may properly be considered more worthy of testing by the objective methods on account of their parentage in the mind of genius. But it is an evil day for science when such parentage is taken as in itself a sufficient warrant for the truth of the ideas which have been born of it, for then it is that authority is allowed to usurp the place of

[1] See Grote's Aristotle, i. 51.

verification. Instead of her true motto, "Prove all things," Science thus adopts its very opposite, "Only believe."

Now, the whole history of Science has been more or less blotted by this baleful influence of authority, which, even in our own days, is far from having been wholly expunged. But in no part of her history has this influence been exerted in any degree at all comparable with that which was thrown over her, like a shadow, by Aristotle. Partly owing to the magnitude of his genius, but still more, I think, to the predominance of the spirit in the dark ages which regarded submission to authority as an intellectual virtue, through all these ages stood to science the name of Aristotle in very much the same relation as stood to religion the name of God. His writings on purely scientific subjects were regarded as well-nigh equivalent to a revelation, and therefore the study of Nature became a mere study of Aristotle. There was almost a total absence of any independent inquiry in any one department of science; and even in cases where the utterances of Aristotle were obscure, the men of intellect who disputed over his meanings never thought of appealing to Nature herself for a solution. They could only view Nature through the glasses which had been given them by Aristotle, and therefore the only questions with which they troubled themselves were those as to the exact meaning of their oracle.

It is, of course, only fair to add that Aristotle himself was in no way responsible for this evil effect of his work. The spirit in which his work was thus received was quite alien to that in which it had been accomplished, and alike by precept and example he was himself the most noble opponent of the former that the world has ever produced; and therefore I doubt not, that, if Aristotle could have been brought back to life during the middle ages, he would have made short work of the Aristotelians by himself becoming their bitterest foe: for listen to his voice, which upon this, as upon so many other matters, speaks with the spirit of truest philosophy — speaks, moreover, with the honesty of a great and beautiful nature — let us listen to what this master mind has told us of its own labors, and with a veneration more worthy than that of the Aristotelians let us bow before the man who said these words: —

"I found no basis prepared, no models to copy. . . . Mine is the first step, and therefore a small one, though worked out with much thought and hard labor. It must be looked at as a first step, and judged with indulgence. You, my readers or hearers of my lectures, if you think I have done as much as can fairly be required for an initiatory start, as compared with more advanced departments of theory, will acknowledge what I have achieved, and pardon what I have left for others to accomplish."

GEORGE J. ROMANES.

NOTES AND NEWS.

"IT is my belief," said a representative of the Scott Stamp and Coin Company of New York to *The Illustrated American*, recently, "that there never was any 1804 dollar. That dies were cut in that year, similar in all respects, save the date, to the dies of 1803, is certain. It is also certain that these dies were destroyed in 1869. But no dollars or half-dollars were issued in that year, nor were they issued at any time by governmental authority.

— The Bureau of the International Congress of Geologists has decided that its fifth session shall be held at Washington, and the date of the session has been fixed for the last Wednesday (26th) of August, 1891. The annual meeting of the American Association for the Advancement of Science and the summer meeting of the Geological Society of America will be held in the same city during the preceding week. The committee of organization will endeavor to obtain from the ocean steamship lines the most favorable terms for the transportation of foreign members to and from the United States, and to arrange with the respective railroad companies for reduced rates for the geological excursions. To accomplish this satisfactorily, it is important that they should know beforehand the approximate number of members who propose to attend the meeting, and that they should have an expression of opinion from these members in order to arrange in advance a series of excursions to places that will be of interest to the greatest number. Owing to the great number of points of geological interest, and to the great distances to be traversed, it would be impossible for the committee to arrange these excursions so that their expense should fall within reasonable limits, without some such previous information. Any geologist who may be desirous of taking part in the congress, or of receiving its publications, which will probably include many valuable geological papers, who will send his name to the secretary, S. F. Emmons, 1330 F Street, Washington, D.C., will be put upon the list and receive the invitation to become a member of the congress. The small fee for membership ($2.50) is for this congress only, and intended to defray the cost of printing and other necessary expenses. It is customary for geologists of the country where the congress is held to subscribe, even if they cannot be present at the congress.

— The Audubon Monument Committee of the New York Academy of Sciences acknowledge the following subscriptions to the Audubon Monument fund: previously acknowledged, $1,298.-50; Morris K. Jesup, A. R. Eno, Andrew G. Carnegie, Thomas A. Edison, James Constable, William E. Dodge, William Schermerhorn, Charles Stewart Smith, C. G. Gunther's Sons, W. W. Astor, J. Pierpont Morgan, C. P. Huntington, Robert Hoe, and Charles Lanier, each $100; Parke Godwin, $25; Coleman Drayton, $5; R. H. Derby, 5, — total $2,733.50. It thus appears that the result of four years of hard labor on the part of the committee has not been quite $3,000. There is certainly a lack of interest in raising money for this object which calls for an explanation.

— At a meeting of the Royal Meteorological Society, London, on Feb. 18, Mr. C. Harding read a paper entitled "The Great Frost of 1890–91." This paper dealt with the whole period of the frost from Nov. 25 to Jan. 23; and it was shown that over nearly the whole of the south-east of England the mean temperature for the fifty-nine days was more than 2° below the freezing-point, while at seaside stations on the coast of Kent, Sussex, and Hampshire, the mean was only 32°. In the extreme north of Scotland, as well as in the west of Ireland, the mean was 10° warmer than in the south-east of England. In the southern midlands and in parts of the south of England the mean temperature for the fifty-nine days was more than 10° below the average; but in the north of England the deficiency did not amount to 5°, and in the extreme north of Scotland it was less than 1°. The lowest authentic reading in the screen was 0.6° at Stokesay, in Shropshire, but almost equally low temperatures occurred at other periods of the frost. At many places in the south and south-west of England, as well as in parts of Scotland and Ireland, the greatest cold throughout the period occurred at the end of November; and at Waddon, in Surrey, the thermometer in the screen fell to 1°,—a reading quite unprecedented at the close of the autumn. At Addington Hills, near Croydon, the shade thermometer was below the freezing-point each night, with one exception, and there were only two exceptions at Cambridge and Reading; while in the Shetlands there were only nine nights with frost, although at Biarritz frost occurred on thirty-one nights, and at Rome on six nights. At many places in England the frost was continuous night and day for twenty-five days, but at coast stations in the north of Scotland it in no case lasted throughout the twenty-four hours. On the coast of Sussex the temperature of the sea was 14° warmer than the air throughout December, but on the Yorkshire coast it was only 6° warmer, and in the Shetlands and on parts of the Irish coast it was only 3° warmer. The Thames water off Deptford, at two feet below the surface, was continuously below 34° from Dec. 23 to Jan. 23, — a period of thirty-two days,—while the river was blocked with ice during the greater part of this time. In Regent's Park, where skating continued uninterruptedly for forty-three days, the ice attained the thickness of over nine inches. The frost did not penetrate to the depth of two feet below the surface of the ground in any part of England; but in many places, especially in the south and east, the ground was frozen for several days at the depth of one foot, and at six inches it was frozen for upwards of a month. In the neighborhood of London the cold was more prolonged than in any previous frost during the last hundred years, the next long spell being fifty-two days in the winter of 1794–95, while in frost lasted for fifty days, and in 1788–89 for forty-nine day

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The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

The Threatened Abandonment of the National Zoölogical Gardens.

A LITTLE over a year ago it was the source of the very greatest gratification to American science that the bill before Congress had passed, and a liberal initial appropriation had been made to establish a national zoölogical garden at the seat of the general government at Washington. Outside of strictly scientific circles, thousands upon thousands of earnest sympathizers all over the country likewise rejoiced in the success of the movement. The great mass of intelligent and cultured people of this nation felt a secret satisfaction when the broad project took on shape and became a living fact. Thoughtful men, wise and far-reaching minds, felt it to be one of the best indices of our national growth, culture, and civilization; for we well know that the nations of the world most distinguished for such characters invariably support such institutions, as they do, indeed, great libraries, galleries of art, and the museums.

To-day it is with deep concern that the intelligent well-wishers — and their name is legion in America — regard the miserable wrangle that is now being enacted in Congress over this entire matter, — an ill-directed debate, that, as it proceeds, daily enhances the danger of defeating the entire measure, undoing all the good that has been done. Nor is this feeling of concern confined to this country; for science the world over deplores the present state of affairs just as much as we do, for there is a broad freemasonry among those who have at heart the progress of learning, the aims of general education, and the advancement of any step that promotes a truer civilization.

But, upon my word, I am almost constrained to believe sometimes that the *personnel* of this government of ours really believes that we have arrived at such a high pitch of civilization in the United States that we are above all such matters: in fact, we are living in an atmosphere far above such questions as the maintenance of public libraries, zoölogical gardens, national universities, or museums.

Viewed from this point, it is a delightful thing to contemplate the marvellous rapidity with which our present-day civilization is advancing. To touch upon a few practical points in the question now under consideration, the writer is moved to say, and I believe I voice the opinions of many other scientists beside myself, that the greatest praise was due to Mr. W. H. Hornaday and Senator Beck for their unflagging energy in carrying through Congress the bill to establish our National Zoölogical Gardens; that the people of the District of Columbia, and of Washington in particular, lent their most hearty aid in the premises, as would any other honest and patriotic American city in the same place, and now it is an outrage to expect her to support any part of what purports to be a purely national enterprise; that the Rock Creek Park is one thing, and the National Zoölogical Garden is another; that, as highly important as an astro-physical laboratory is, and notwithstanding the evident demand for such an institution, it surely has nothing to do with a zoölogical garden, any more than the moon has to do with the beard on the chin of a buffalo; that the time has most assuredly arrived for this country to establish, support, and maintain a complete, extensive, and properly conducted national zoölogical gardens at the seat of her general government, — gardens that can at least rival those of Regent's Park in London, or the superb ones maintained at Amsterdam; and assuredly nothing less, or none at all. My views upon the conduction of such establishments, together with their aims and uses, have already been published in *The Popular Science Monthly* of New York (April, 1889), and those views were very fully republished in *The Evening Star* of Washington, D.C.: so it is quite unnecessary to touch upon that part of the subject again in the present connection. R. W. SHUFELDT.

Takoma, D.C., Feb. 26.

A Water-Beetle.

LATELY I kept for a few days for inspection that very beautiful insect a water-beetle. The specimen was large and splendidly colored, gold-banded, and displaying brilliant iris hues on its legs. I placed it in a glass jar of water. On the surface of the water some leaves were laid. On one side of the jar, at the bottom, was pasted a square of paper, and to the shelter of this the beetle often retired. It seemed to take the greatest delight in darting, swimming, and diving, rising from the bottom of the jar to the top of the water by long, vigorous strokes of its hind-legs. Then joining its second pair of legs before it, like a swimmer's hands, and stretching the hind pair out nearly together, it would dive to the bottom. It slept hanging head downward under the leaves, with the tip of the body above the water to secure air.

It showed the pleasure of a child in "blowing bubbles." Rising to the surface, it would put the tip of its body above the water, part the elytra, and take in air; then, closing its case, it would dive to the bottom, stand on its head, emit the air-bubble by bubble until it was exhausted, and come up for a new supply. It seemed to need the daily renewal of the water in the jar. When it was hungry, or the water was not fresh enough, it became dull and sulky, and hid behind the paper. After the beetle had fasted twenty-four hours, I laid on the top of the water a wasp, a mosquito, a blue-bottle fly, and a common fly, all dead. The beetle, being at the bottom of the jar, did not seem to see or smell these insects. Rising presently, he came up against the mosquito, seized the body in his jaws, and sucked it dry with one pull. He then found the blue-bottle, carried it down to the shelter of the paper, trussed it neatly, cutting off the wings, legs, and head, and letting them float to the surface. He then held the body in his hands, or short front-feet, pressed to his jaws, and sucked it dry. After this he rose to the surface, found the other fly, and served it in the same fashion. Next he found the wasp, a large one. Carrying this below, as he had the flies, he clipped off the wings and legs, but took the precaution to suck the head and thorax before turning them adrift. He also grasped the body in his hands, pressed the part that had been cut from the thorax to his mouth, and, holding it exactly as if drinking out of a bottle, he drained it dry.

I found that he could eat all the time, except when he was asleep or playing, and his activity was in proportion to the quantity of his food. Cooked meat he would none of. Raw beef he did not greatly like, but raw veal he prized even above wasps and

blue-bottles. I cut an ounce of raw veal into dice, and dropped it in the bottom of the jar in a heap. He did not seem to see or smell it, but after a while happened to dive into it. He appeared to be full of joy at the discovery. One fragment after another he took in his hands, held it closely to his jaws, and sucked it dry by strong pulls. At each pull I could mark the receding red juice of the meat. When the veal was reduced to a pale fibre, he let it go and took a fresh bit. He always retired to the shelter of the paper to eat, with the sole exception of the mouthful he made of the mosquito. Like the King of Dahomey, he would not eat in public.

JULIA MCNAIR WRIGHT.

Fulton, Mo., Feb. 26.

Cold and Warm Waves.

THE observations taken at the meteorological establishment on the Eiffel Tower in Paris have led to several most interesting results; and among other things it has recently been found that the velocity of the air during an ordinary strong wind is about twice as high at the top of this tower as it is at its base. Such being the case, we should expect to find advancing cold or warm waves far ahead in upper regions of what they are closer to the earth's surface; and so they actually are found to be, as mentioned by Professer Hazen in your last issue, when he says that the temperature change at isolated mountain-peaks, as Mount Washington or Pike' Peak, occurs several hours earlier at their tops than at their bases, or when he says that high areas, etc., advance with a velocity double that of the surface air. These phenomena give us, therefore, a very instructive illustration or proof of the effect of the friction between the earth's surface and the air moving over it; and they confirm the old popular belief that weather-changes are brought about by the wind, or, what amounts to the same thing, that the advance of cold and warm waves is entirely due to mechanical action, or displacement of the surface-air as a body, in conformity to such rules as I have set forth in my paper, "On the Cause of Trade Winds" (*Transactions of the American Society of Civil Engineers*, vol. xxiii.), which paper also gives a very simple clew to the increased cold or heat in the border current of cold and warm waves.

Professor Hazen, however, does not appear to be acquainted with the important results of these observations at Paris, when he concludes that the changes in temperature and humidity of the air accompanying the advance of these waves cannot be due to the wind, or are entirely independent of the motion of a mass of air, although he curiously enough states at the same time that a rapid motion of an advancing wave has a tendency to increase the wind, which seems contradictory.

Starting from these false premises, no wonder our meteorologist arrives at some most startling results. He finds that the moisture of the air is "removed," "eliminated," or, as he says elsewhere, "sucked out" of the air in less than no time by some mysterious agency or another which cannot as yet be accounted for. Storms are transported or transferred through the air without the air-particles being moved at all. Indeed, when it is considered that the literal meaning of the word "storm" is "violent agitation or commotion," or, in other words, "wind," he wants to tell us that when a wind blows, the air-particles don't move at all: it is all deception, and the storm is due to electric energy or something else. The professor's mistaken notion here is, however, precisely similar to the one I pointed out in my last letter, when I tried to explain the fallacy of the result he arrived at,— that condensation did not always take place when saturated air "got chilled." His ideas of the principles of motion seem to differ remarkably from those engineers are accustomed to go by.

Finally, an entirely different subject is brought up by him, and treated in the same mysterious manner: "A portion of the heat in our storms is due to a peculiar condition of the atmosphere which intercepts the heat of the sun, and this heat gradually works down from the upper atmosphere to the earth." Mightn't it be simpler to say that when the sun is prevented from warming the earth's surface, its heat is taken up by the clouds, and consequently, when the cloud-carrying layers are brought near the earth's surface, as we know they are towards rain, this heat is felt by us?

Professor Hazen is a meteorologist without a theory; and, although it may be much easier to run down than to build up, no doubt he has done excellent service by constantly finding fault with others in just conformity to this negative standpoint; but, as the professor always seems so very anxious "to strike at the very heart of present theories of storm-generation," and this evidently in his strong point, I may recommend him to strike at the heart of a rain theory I some time ago had the honor of presenting to the American Society of Civil Engineers, and he may thereby possibly be able to prove that his notions of the principles of motion, etc., are more correct than those held and practised by the members of that distinguished body.

FRANZ A. VELSCHOW, C.E.

Brooklyn, N.Y., March 2.

The Piney Branch Indian Workshop.

THE "Annual Report of the Curator of the Museum of Archæology, Philadelphia" (Vol. i. No. 1) contains a criticism of recent work done, and conclusions drawn, by Mr. W. H. Holmes of the Bureau of Ethnology at the Piney Branch Workshop, near Washington, D.C., and of Mr. Holmes's papers thereon (*American Anthropologist* of January and July, 1890), that to the writer appears to do great injustice to Mr. Holmes.

In his report, Dr. Abbott, who has visited the site and obtained specimens therefrom through Mr. Holmes, says, "The enormous number of 'blocked out' implements have recently been held as conclusive evidence that such objects are to be considered as 'failures,' and, this being so, that similar objects found under any circumstances in this country are of like signification." To such conclusion the doctor dissents (p. 8).

Again he says, "While the position taken by Mr. Holmes and others as to the archæological significance of the Piney Branch deposits may be wholly correct, and stand the test of every objection, the inferences drawn are too sweeping, and have not necessarily the bearing upon the question of man's antiquity in America which he practically claims. The conditions under which rude paleolithic implements occur in the valley of the Delaware are wholly different. Here they are characteristic of a horizon; are so associated with a well-marked deposit, that by no verbal jugglery can they be relegated to 'incongrous association,' and so are adventitious" (p. 9).

And concluding, the doctor says, "On the other hand, to accept Mr. Holmes's conclusion, that all rude implements, howsoever and wheresoever found, are Indian 'failures,' is not merely to remove from the class of implements the so-called 'turtle-backs' of the Delaware valley, but to remove the paleolithic implements of Europe, Asia, and Africa from the prehistoric archæology of those continents."

Mr. Holmes is an officer of the Bureau of Ethnology, whose works on pottery, on the antiquities of the South-West, and on the Chiriquian objects, have familiarized his name to all students of American archæology as a most painstaking and careful investigator; and, had he taken the ground asserted, he would have laid himself open to the charge of want of due care in conducting a scientific work.

Thus it will be observed that Dr. Abbott first says the Piney Branch objects "have recently been held as conclusive evidence that such objects are to be considered as failures," and dissents from such conclusion. Again he says, "Whilst the position taken by Mr. Holmes and others" may be correct as to Piney Branch, the conclusions are too sweeping, and have not the bearing which he (Mr. Holmes) practically claims. And in conclusion, Dr. Abbott, while claiming that the discovery of paleolithic implements of the Delaware valley occurred under different conditions from those under which the implements at Piney Branch were found, says the Delaware valley implements "by no verbal jugglery can be relegated to 'incongrous associations.'" The report starts by saying that the Piney Branch objects "have been held," and, later on, by "Mr. Holmes and others." In the last part of the latter sentence in which "Mr. Holmes and others" occurs, the doctor, in specifying Mr. Holmes individually, saddles the latter with conclusions which began with "have been held," and then defends the paleoliths of the Delaware from being by "verbal

jugglery" relegated to "incongrous association;" the last part of the report saying, "To accept Mr. Holmes's conclusions, that all rude implements, howsoever and wheresoever found, not only removes the turtle-back of the Delaware valley, but removes the paleolithic implements of Europe, Asia, and Africa from the prehistoric archæology of those continents." In reading the curator's report of the Museum of Archæology relating to Mr. Holmes's work at Piney Branch, and the curator's views thereon, in connection with Mr. Holmes's papers in the *American Anthropologist* referring to this work, I was greatly surprised to find that Dr. Abbott's opinion and conclusions differed so widely from the conclusions which I had drawn from a tolerably careful examination of Mr. Holmes's work while excavating, from a careful reading of his papers, and from what I knew to be his ideas on the subject.

Mr. Holmes, under the direction of the Bureau of Ethnology, dug trenches into the hill at Piney Branch in order to develop the aboriginal workshop on the site. His papers in the *American Anthropologist* are simply an expression of what was developed in the trenches. In the January number of the *American Anthropologist* (1890) his plates of his work are as perfect as art can represent such work, or science could desire it should be represented. The objects found scattered throughout the "shop," from the surface to the cobbles in their original position, demonstrated beyond contradiction that the whole "shop" from end to end, from surface to bed, contained one class of work. Objects identical in material, shape, and manipulation, are found throughout the valley of the Potomac; and I have hundreds of similar specimens from the Patapsco, and South River in Maryland. The shape and work are not distinguishable from those of the paleolith of Europe; and many persons around Washington concluded that our turtle-back, or possibly, better, the double turtle-back, was of the paleolithic age. The Piney Branch shop demonstrated that on that site probably millions of stones had been worked; that those stones were identical with the finds of the Potomac and its vicinity. This is accepted by all as beyond contradiction. Of the shop, Mr. Holmes (*American Anthropologist*, July, 1890, p. 224) says, "A hundred or a thousand years may have passed since the discontinuance of work upon this site. In the Delaware valley all the necessary elements of a time record exist, and there at least the record has been at least partly read." In the *American Anthropologist* (January, 1890, p. 14) Mr. Holmes says, "It causes me almost a pang of regret at having been forced to the conclusion that the familiar turtle-back or one-faced stone, the double turtle-back or two-faced stone, together with all similar rude shapes, must, so far as this site is concerned, be dropped wholly and forever from the category of implements." Further, Mr. Holmes, in the same paper (p. 23), says, "Many of the rude implements of the Seine — assigned to a great antiquity and to an unknown race — are nearly identical with our quarry forms. On the Thames the analogues of nearly all classes of rude implements are found in the high, level gravels, thus carrying history back with certainty to remote ages. In the Delaware valley the rudest forms, corresponding to our failure shapes, are obtained from our glacial gravels, and the less rude varieties occur in more recent formations or under conditions that seem to make them safe indices of the steps of progress. In the Potomac valley, on the other hand, all the rude forms appear to be but failures, or unfinished pieces representing stages in the manufacture of arrow and spear points of the Indian." In conclusion (p. 26) Mr. Holmes says that he is ready to modify any of his statements, conclusions, or inferences, when the facts are found to warrant the change.

If Dr. Abbott can in any place quote Mr. Holmes as either saying, or even intimating, as suggested in his report, by "verbal jugglery" or otherwise, that Mr. Holmes claims that the Piney Branch shop has any bearing "on man's antiquity in America;" or if the curator of the American Museum of Archæology can justify his remarks, "that to accept Mr. Holmes's conclusions, that all rude implements, howsoever and wheresoever found, is not merely to remove the 'turtle-back' of the Delaware valley, but to remove the paleolithic implements of Europe, Asia, and Africa from the prehistoric archæology of those continents," — I am willing to stand corrected. If, on the other hand, the doctor fails to show that any such theory has been advanced by Mr. Holmes, such as attributed to him, the doctor will have to admit, that, as the representative of the institution of which he is curator, he has been as unfortunate in his remarks as unwarranted in his assertions.

Nowhere that I can find has Mr. Holmes made any such assertion as attributed to him. On the contrary, he has strictly confined himself to the character of the work he had in hand, and has demonstrated that the so-called "turtle-back" was not paleolithic in the Potomac valley and its vicinity; and this demonstration has generally been accepted as conclusive so far as it applies to such objects on the field mentioned. He carefully leaves the paleolith to its proper sphere, as a matter which those who have studied and examined have described as being found "in the high level gravels, thus carrying history back to remote ages." To the Delaware valley finds Mr. Holmes accords a probable antiquity that is creditable to him as a liberal judge. There are in my own collection many surface finds from Anne Arundel County, Md., that are so similar to implements found by Dr. Abbott at Trenton, that an impartial judge might question even the great age of the Trenton implements without laying himself open to the charge of an effort to remove the paleolithic age of any country from the realms of "prehistoric archæology."

Notwithstanding the vast amount of valuable work performed by archæologists in America within the last twenty years, archæology may yet be considered in its infancy; and, while fair criticism should be courted by those making archæological investigations, attributing to an investigator thoughts and notions never advanced by him might be considered as verbal jugglery. New theories are too often advanced, and new implements too often described, the originators of which are frequently the first to repudiate them; and every branch of archæology opens too broad a field for archæologists to have to lay the institutions which they represent open to severe criticism in order to strengthen a pet theory.

J. D. MCGUIRE.

Ellicott City, Md., March 2.

Anthropoid Heads in Stone from Oregon.

I HAVE seen the pamphlet of Mr. Terry, describing the anthropoid heads in stone from Columbia River, Oregon. The author offers two suggestions as to their origin. One supposes the existence in former years of anthropoid apes in this region. Professor Marsh, who owns one of the stone heads, could tell us whether any apes or monkeys are known to have existed there. I do not remember to have seen any literature on that subject. The second supposition is, that the people who made the stone heads once dwelt in lands abounding in apes. This is very much more probable. There are many species of anthropoid apes in western Asia, and there is nothing improbable in the hypothesis that the fabricator of the heads, or his ancestors, drew their inspiration from across the Pacific.

If Mr. Terry will allow me, I would suggest that he has omitted a more plausible explanation than either of the foregoing. From Sitka to northern California is the richest timber-belt in the world. The natives of all stocks have depended on the cedar and other trees for house, furniture, clothing, vessels, boats, tools of many kinds, and art materials. They knew how to fell the largest tree, and to divide it into planks and puncheons by means of numerous wedges and stone mauls. These mauls are very abundant in collections. I have seen them in the American Museum, where Mr. Terry's collection is installed. Most of them are carved or pecked into the form of animal heads. The material, heavy eyebrows, round bulging eyes, prominent cheeks, are all identical with the Terry specimens; only, in these, the lower part of the face is ape-like. This is easily accounted for.

The Indians of this region are the most imitative creatures in the world. There are in the National Museum from this very Columbia region, and northward to Puget Sound, collected by Wilkes in 1838, carvings, in wood, bone, and stone, of dogs hitched to boats, steamboats with side-wheels, stoves with pipes and cowls on top, wagons, gates on hinges, glass windows, shingle roofs on houses, and, on a totem post, a missionary stealing two Indian

children. I would not say that all these existed in Oregon and Washington in prehistoric times, nor that the Indian artist had travelled around the world, but that all these things had come to him.

We have an excellent bust of Mr. Cleveland made by an Indian from a scrap of *Harper's Weekly*, which one of our collectors had wrapped around a bundle. It is not at all unlikely that the portraits of Mr. Crowley had found their way to Oregon in the same manner. It was a very popular subject about the time of his death, and the papers were full of him.

However, I am very far from depreciating the specimens on that account. The manner in which the lines of our culture move forward into savage culture is the most important inquiry in the history of civilization. O. T. MASON.

U. S. National Museum, Feb. 28.

BOOK-REVIEWS.

Mineral Physiology and Physiography. By T. STERRY HUNT. 2d ed. New York, Scientific Publ. Co. 8°. $5.

A New Basis for Chemistry; A Chemical Philosophy. By T. STERRY HUNT. 3d ed. New York, Scientific Publ. Co. 12°. $2.

Chemical and Geological Essays. By T. STERRY HUNT. 3d ed. New York. Scientific Publ. Co. 8°. $2.50.

Systematic Mineralogy, based on a Natural Classification. By T. STERRY HUNT. New York, Scientific Publ. Co. (In press.)

THE new and revised edition of the works of the veteran scientist, Dr. T. Sterry Hunt, calls for renewed attention to the great world problems to which he has devoted a long and studious life. Those problems have arisen in the attempts of science to ascertain the ultimate, or at least a truer, conception of matter, and to obtain some theory of the formation of the chemical elements, and then of their combination and order in the formation of the sun, solar system, and especially of our earth. Dr. Hunt, at the close of his "Physiography," calls it "mineralogical evolution," and from it he proposes a new mineralogical classification and nomenclature, and finally "A New Basis for Chemistry."

Those who are not acquainted with the scientific career of the author may at first suppose that an attempt of this adventurous kind belongs to sensational and pseudo-scientific romancing excited by presumption, sentiment, ignorance, and imagination. Far other is the result of a careful examination of these volumes. We find in them a patient, mature, and thoroughly trained physicist, drawing to a conclusion, which he verily believes to be triumphant, the scientific evidence by which he has worked out not only this dream of his own youth, but the dream of the youth of Science herself: for the first question Science had to propose in early Greece, and the last she may have to solve, is the nature of matter and its changes. Her work is all there. How far the solution has progressed is disclosed in an exceedingly instructive history of previous efforts in that regard, made introductory to his own, in Dr. Hunt's main work, "Mineral Physiology and Physiography." This work should be the first taken in hand by the student, and then the "New Basis of Chemistry," and lastly, and by way of greater illustration, "The Essays" and "Systematic Mineralogy." This suggestion may save some disappointment, for Dr. Hunt has little mercy for those not acquainted with scientific methods and terminology. But when taken in the right order, as above indicated, this difficulty gradually disappears. The interest in the subject, than which none can be more sublime or important, fully repays the labor required to master its technicalities.

There are few scientists who are competent to give opinions of weight upon these fundamental questions, but none can be indifferent to them. To compare these great matters with small, we may say that Dr. Hunt has attempted to do for the mighty universe of inorganic matter what Darwin and the modern biologists have done for the little organic world of protoplasm. It is singular that we have been led to chiefly think this little organic world to be complex and inexplicable when compared with physics and chemistry; but the fact seems to be that during this century the organic world has been pretty well made out. Given protoplasm as found in nature, and the laws of growth and environment, and evolution tells the rest of the organic story — except to people who seem to have some reason for not wishing to have the "mystery" solved. So much having been accomplished as to organized matter, Dr. Hunt's works bring forward anew the very timely question, "Is there also one universal substance which, in its knowable changes and combinations, can give us the solution of the vast material world?" The contrast with the organized matter may be used only to state the question; for their methods must be quite disparate, and should never be confounded. Dr. Hunt answers this question affirmatively. He begins with the hypothesis of Newton and his successors, that the universe as far as known is a *plenum* of ether, and from the properties of light, heat, electricity, chemical affinity, etc., infers its reality. From astronomical and spectroscopic data he infers that the nebulæ from whence sun systems result are ethereal condensations. "Thus, perhaps," says Newton, "all things may be originated from ether;" and we are gradually brought to see this hypothesis gather the strength of a true theory under the light of the latest discoveries.

The author carefully lays away the atomic theory as unscientific, and the source of the principal misunderstandings of nature. The counter theory of the ultimate continuity of matter is then brought forward as the basis of the new philosophy by which only the ether theory of Newton (contrary to his own view) can be sustained. We then are taught that "all chemical union is nothing else than solution:" the uniting species or forms of matter are simply dissolved in each other. Chemical union is the identification of the combining bodies in volume and character in the new species formed. The type of the chemical process is found in solution, from which it is possible, under changed physical conditions, to regenerate the original species. All of these "may be supposed to be formed from a single element, or *materia prima*, by the chemical process." The "New Basis for Chemistry" (pp. 16–23, 35–37, *et passim*) elaborates this view. In the third chapter we are introduced to the *materia prima*, from which, by a process of cooling and electric changes, the chemical elements result by a process of "successive polymerization." Matter in its simple form, which must be far beyond the tenuity of hydrogen, can only be looked for by the spectroscope under the inconceivable heat of the grander suns. The author evidently believes that the later observations indicate forms of a primal matter, which, under heat and electrical changes beyond our present intelligence, polymerizes, and appears to us first as chemical elements, and hence as gases, and thence, as polymers of gases arise, under decreasing heat, as liquids, colloids, and solids.

From this vantage-ground the author has the basis of a new law of numbers, weights, volumes, densities, etc.,— in a word, a new chemistry. By its light the combinations of matter are reviewed from the experiments of the laboratory to the mighty changes of stellar nebulæ. The stratified "rock-ribbed" bones of our planet are accounted for by an order determined by the nature of the materials, their chemical union, and modes of condensation.

The author takes unmeasured pains to work mineralogy and geology into orderly sciences by showing how the granitic rocks were chemically formed, and then forced to the surface and into the solid forms in which they now appear by "crenitic" or spring-like action. Thus we have a rational, uniform, chemical, account of our sun's and of our earth's formation and history. The chaotic appearances on the earth's surface are not evidences of catastrophes, but the results of the condensation of matter, and the crenitic and other re-arrangements which that process necessarily compelled. Thus we are made to conceive of ethereal, gaseous, liquid, colloid, and solid matter as one infinite polymeric world-forming, never-ending drama.

In order to realize this vastly improved science of matter, our author shows that much of the scaffolding which has served well in the past building of such a science now really prevents its completion. He especially shows that the atomic hypothesis, the present chemical notation, and classification, and the treatment of mineralogy, are not true, or but partly so, and should be replaced by the completed theory of matter and its polymeric changes and

combinations as a continuous history. All of this daring proposal leads, of course, to a scientific revolution similar to that accomplished by Lamarck, Darwin, and Haeckel in biology. And this, we have to keep recalling, is not the work of a tyro, but of a *savant* recognized and honored as such in the front rank of physicists the world over. We grant that only those in that rank, and gifted also with rare powers of generalization, can competently weigh the evidence and appreciate the theory which the industry of a long life has presented in these volumes. It is a theory which certainly must wait for final completion; but as a working hypothesis, in the absence of any other, it is a unitizing, completing scheme of nature, invaluable as a suggesting power, and as a centre around which the results of scientific observation and experiment may be intelligently gathered, and then held as parts of one mighty world drama. It may be further said, that, however the author may come short of present sufficient evidence of his hypothesis, he has rendered very dubious, if not wholly untenable, the old notions of matter, and of all chemistry based upon the atomic hypothesis. Hereafter we are to have neither an atom nor a vacuum, but a continuous world of continuous matter, with all of its world creative changes and combinations accounted for by a continuous law formulated in a nomenclature expressive of that unity. The realization of this dream of Newton, Huygens, Young, and their many patient followers, of whom our author is one, would certainly be the crowning glory of our race. To date the solution of both the vital and the material worlds in the same century would seem to be pressing Father Time too rashly of late; and he may properly leave us to evolve through another century before we reach the sufficient evidences of the true theory of ether and matter, suns and worlds.

T. B. Wakeman.

AMONG THE PUBLISHERS.

A comprehensive life of Gen. Sherman is about to be published and sold through agents by Hubbard Brothers of Philadelphia.

— John Wiley & Sons announce as in preparation "Ordnance and Gunnery," by Capt. Henry Metcalfe, U.S.A.

— Macmillan & Co. have just published "The Fossil Insects of North America, with Notes on some European Species," by Dr. Samuel H. Scudder. The work is in two volumes, with sixty-three plates and numerous illustrations in the text. These volumes, of which only one hundred copies are issued, form the most extensive work of the kind ever published. Over eight hundred and fifty species are described, most of them being figured on the lithographic plates. The descriptions include, with two or three exceptions, all the fossil insects ever described from North America, besides a large number now first published. Besides the merely descriptive matter, the general student will find essays on the classification, distribution, and geological sequence of the different groups. The term "insects" has been used in a broad sense to include myriapods and arachnids, as well as hexapods, or true insects.

— E. & F. N. Spon of this city have issued their catalogue for 1891, of books relating to civil and mechanical engineering, arts, trades, and manufactures. It contains 118 pages, and is illustrated.

— Every person interested in the higher education would be interested in the article on "The Growth of New England Colleges," by Professor Arthur M. Comey of Tufts College, which appears in the *Educational Review* for March. It appears to revolutionize the discussion regarding the shortening of the college course, for it contradicts by statistics one basis of the affirmative argument; viz., that college attendance in New England has not kept pace with population. Other articles are one on "The Primary School in the Middle Ages," by Brother Azarias of De Lasalle Institute; the concluding part of "The Herbartian System of Pedagogics," by Professor Charles De Garmo; one embodying the latest philosophical generalizations regarding "The Psychological Study of Children," by Professor Joseph Jastrow; and discussions of "The Pronunciation of Greek," by G. C. Sawyer; "The Results of the Prussian Commission on School Reform," by Henry Wood; and "Imagination in Mathematics," by Larkin Dunton.

— The principal topics discussed in *Babyhood* for March are "Size and Weight of Infants" (illustrated); "The Ideal Nursery;" "Intestinal Worms," a description of the symptoms which characterize their presence, and the treatment; and "Defects that can be Remedied or Prevented.

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SCIENCE

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CALENDAR OF SOCIETIES.

Biological Society, Washington.

March 7.—F. A. Lucas, Exhibition of Young Hoatzins, a Specimen of Bison latifrons from Florida; T. H. Bean, The Fishes of Great South Bay, Long Island; J. N. Rose, A New Aster from Southern California; George B. Sudworth, Color and Odor of Flowers in attracting Insects; J. M. Stedman, Embryo of a Chick with Two Protovertebræ.

Anthropological Society, Washington.

March 3.—William H. Holmes, Function of Tempering in Earthenware; J. D. McGuire, The Stone Hammer and its Many Uses.

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INFORMATION WANTED.—Clarence W. Bowen, Secretary of the Committee on the Centennial of Washington's Inauguration, 251 Broadway, New York, desires information regarding the portraits of John Hathorn and Jeremiah Van Rensselaer, members of Congress from New York. These portraits, for the Memorial Volume, are particularly desired, to complete the list of portraits of the New York delegation in Congress at the time of Washington's inauguration.

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WANTED.— An Entomologist to accompany a camping party of boys during July next. Address, stating experience and salary expected, ALBERT L. AREY, Free Academy, Rochester, N.Y.

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I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

I have a good supply of Eastern Coleoptera which I wish to exchange for species not in my collection. Melandryidae and Oedemeridae especially desired. Joe C. Thompson, Rosebank P. O., Box 73, S. I.

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1890 Seeger and Guernsey Cyclopedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost $6. David R. Lewis, Saybrook, Ill.

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NEW YORK, MARCH 13, 1891.

INSTRUCTION OF THE DEAF.[1]

THE essential difference between the oral and manual systems as methods of instruction lies in this: that with the former, articulate speech is developed, and made the chief means of communication between teacher and pupil; while with the latter, as applied in this institution, writing, spelling, and signs are developed, and made to perform the same office. Mental development and the acquisition of knowledge are the great end and aim of both systems. Intellectual development is the one prime necessity of all deaf-mute instruction, and, whatever the system pursued may be, this grand aim and object of all effort should be constantly kept in view. Of what possible use would be the power of speech with no thoughts to utter; of what avail writing or spelling with no ideas to express? The means of instruction must not be mistaken for the end: the structure reared is of vastly greater importance than the mere implements by which the work has been accomplished. Whether our pupils be instructed orally or manually, our great purpose is to make them rational, thinking beings.

In favor of the oral system, it cannot be maintained that vocal utterance is essential to the operation of the mental faculties, or that it is absolutely necessary for purposes of social intercourse, for it is well known that these ends, so indispensable to intelligent and rational existence, may be attained by other methods; nor can it be maintained for it as a system of instruction that it is superior to other systems as a means of mental development, or as an aid to the acquisition of language, although in the latter instance it certainly does possess some advantages not generally appreciated by the adherents of opposing systems.

The oral system rests its claims to superiority upon quite different grounds. Speech is a more general and more available form of communication than writing, spelling, or signing. The great hearing world, of which the deaf must ever form a very small part, speaks and understands spoken language; but too often it is unable to write, and almost always is unable to spell on the fingers or to sign. Speech, therefore, brings the deaf man who may be so fortunate as to possess it into closer relations with his hearing fellows, and affords him a wider field for the play of his ambition and for the exercise of his social instincts. Speech is the mental coin of the world. Stamped in it, the thoughts, hopes, and loves of the deaf pass current, unaffected by the existence of their physical infirmity, and without discount on account of their misfortune. It makes the whole world kin, it satisfies the innumerable daily experiences of social and business life, it meets more fully than any other form of human communication the demands of human affection. What wonder that parents thrill with delight as they catch the first feeble whisperings of speech from the lips of their deaf children! What wonder that fathers and mothers constantly ask, "May my child be taught to speak?" Surely no labor, no study, no unremitting exercise of care and attention, can be weighed in the balance with the immense benefit and consolation which speech affords to the child bereft of its hearing.

In sympathy with these views, it has been the policy of this institution for some time to provide separate oral instruction for those of its pupils who may profitably be instructed by that method. The wisdom of this policy is becoming more and more apparent in the excellent results attained, and it is only a question of time when a larger proportion of our pupils than we are now able to reach shall receive the benefit of this form of instruction.

On the other hand, for those pupils who cannot be satisfactorily instructed under the oral system, the board with equal wisdom as assiduously and carefully provides the most approved methods of manual instruction. In these features of its system of instruction, the Pennsylvania Institution enjoys a most signal advantage over any other school for the deaf in existence.

In a school in which oral instruction is alone provided, a large percentage of the pupils must derive but very little benefit; so, also, in a pure manual or combined school, a large number who might be orally taught have no adequate opportunity to acquire speech and speech-reading. In maintaining the two systems side by side in friendly rivalry as to which may most excel, it is believed that this institution, in the fulfilment of its high mission, provides every possible advantage for the instruction and advancement of its pupils: it offers speech to those who can acquire it; language, knowledge, intellectual growth, to all.

In securing the mental development of the deaf, natural signs may, without doubt, be made to perform a most important function. Their value, however, is sometimes overestimated, and their usefulness abused. Their best use, except for purposes of illustration and discipline, is found to be in the lecture-room, where are gathered together a large number of pupils for moral and religious instruction. In the class-room they should be sparingly used at all times, certainly never when written or spelled language may be used instead.

There is much diversity of opinion as to the limitations and restrictions that should be observed in the use of the language of signs. It is insisted upon by some that they should be limited to the same office and function they perform in the case of the acquisition of language by the hearing child. The gestures and actions of the mother or nurse alone give meaning to uttered words. Joy, fear, approval, love, are read in the mother's face and actions with unmistakable certainty the while the uttered sounds are being poured into the child's ears. Material objects, in the same way, are named when seen and handled; and each passing event is seized upon and made to perform an important office in impressing upon the child's memory the meaning of words and sentences.

In this way, through the agency of natural signs and gestures, the hearing child acquires speech; and in this way and to a like extent some of our most successful manual and oral teachers of the deaf employ the sign-language, and, as in the case of the hearing child, as soon as verbal forms have been acquired, they seek to discontinue their use.

[1] From the Annual Report of the Board of Directors of the Pennsylvania Institution for the Deaf and Dumb, for the Year 1889-90.

Others, again, place a much higher and more extended value upon their effectiveness as a means of development, and, instead of employing their time to perfect their pupils in the knowledge and use of that language which alone can introduce them to the world of thought and information, exert themselves to extend their acquaintance with natural and methodical signs, and to make them masters of pantomimic action. This to me is a most reprehensible practice and a complete perversion of the true use of signs in the instruction of the deaf.

Concerning the use of signs, Mr. Luzerne Rae says, "A too abundant and constant use of signs is the grand practical error of American institutions for the deaf and dumb."

Dr. E. M. Gallaudet, president of the National Deaf-Mute College, in an able article in the *American Annals*, maintains that "until a deaf-mute can think freely in conventional language, and express his thoughts fluently and correctly in the same, every instance of the use by him or to him of the language of signs in its natural order, impedes his progress toward the great end and object of his education."

In the oral instruction of the deaf, except in the earlier stages, signs as a means of communication should be carefully prohibited; in manual instruction they should be used as sparingly as possible at all stages. If the deaf are to satisfactorily acquire speech and speech-reading, they must early learn to rely upon them for all purposes of communication; and if they are to acquire fluency and correctness in the written forms of the language, they must be required constantly to express their ideas in the same. The continued general use of signs will in either case prove highly detrimental to the great end and object of instruction, and no intelligent teacher will prolong their exercise one moment after they have served their legitimate purpose. Like the scaffolding used in the erection of a building, which, however helpful and necessary during the course of construction, having served its purpose, is cast aside, with the completion of the edifice, as something not only unnecessary to the strength and duration of the structure, but as something, which, if permitted to stand, would prove a most serious debasement of its beauty and utility, so signs, however rapid and convenient and helpful they may be as means of communication and mental development, in the various stages of intellectual growth, having served their purpose, should be rigidly cast aside as debasing and detrimental to that newer and more perfect language which it is their proper function to aid in attaining. A. L. E. CROUTER.

TEMPERATURE IN THE GLACIAL EPOCH.[1]

THE late long frost has naturally suggested the question, "What permanent fall of temperature would produce a recurrence of the glacial epoch?" It is a question not easily answered, for it is like a problem complicated by too many independent variables. It is not enough for us to ascertain the actual temperature of a district in order to determine whether it will be permanently occupied by snow and ice. There are regions where the ground, a short distance below the surface, is always frozen to a depth of several yards at least; and yet glaciers do not occur, even among the hills, because the amount of precipitation is so small that the summer rapidly dissipates what the winter has collected. There are other regions partly covered by ice, though their mean annual temperature is distinctly above the freezing-point; as where glaciers descend to the sea from hilly districts, of which a considerable area lies above the snow-line, and on which there is much precipitation. In the case of Great Britain, at least, a further difficulty enters into the problem; namely, that much controversy still prevails as to the interpretation of the symbols upon which our inferences in regard to the temperature of these islands during the glacial epoch must depend. Some authorities would concede no more than that the highland districts of Scotland, Wales, and England were enveloped in snow and ice, and the glaciers, whether confluent or not, extended from their feet for a few leagues over the lowlands, say, to some part of the coast of Lancashire and of Northumberland; while others desire to envelop a large part of the British Isles in one vast winding-sheet of ice, a corner of which even rested on the brow of Muswell Hill, above the valley of the Thames. The one school regards the bowlder clay of England as a deposit mainly submarine, the product of coast-ice and floating ice in various forms: the other attributes it exclusively, or almost exclusively, to the action of land-ice. Into this thorny question we do not propose to enter. The approximation which we shall attempt — and it can only be a rough one — can be easily modified to suit the requirements of either party.

[1] From Nature.

We will assume throughout that the annual isothermal of 32° coincides with the line of permanent snow. This, obviously, is an assumption. Often, owing to small precipitation, it will be found to be erroneous; but we take it as the only simple approximation, for, under favorable circumstances, masses of ice may protrude beyond it.

The question, then, may be put in this form: "Assuming a sufficient amount of precipitation, what changes of temperature are required in order to bring within the isothermal of 32° regions which are generally admitted to have been occupied by land-ice during some part of the glacial epoch?"

First, in regard to the British Isles. All will admit that in many places the Cumbrian and Cambrian glaciers descended to the present sea-level. The mean temperature of the Thames valley near London is 50° F. This isotherm cuts the Welsh coast a little east of Bangor. Obviously, the whole region north of this line has a lower mean temperature; no part of the British Isles, however, being below 45°. Hence a general fall of 18° would give a temperature of 32°, at most, in the Thames valley and on the shores of North Wales (except on the extreme west), while on the coasts farther north the temperatures would range down to 27°. What would be the effect of this? Switzerland may enable us to return an answer. The snow-line in the Bernese Oberland may be placed roughly at 8,000 feet above the sea, but it is obvious that the chief feeding-ground of the Alpine glaciers lies rather higher up in the mountains. In the case of such glaciers as the Great Aletsch, or the Aar, the lowest gaps in their upper basins are rather above 10,000 feet; while the surrounding peaks range, roughly, from 12,000 to 14,000 feet, though but few exceed 13,000 feet. Thus the feeding-ground of the Oberland glaciers may be regarded as equivalent to a mountain district the sky-line of which ranges from rather above 2,000 to 5,000 feet. In reality, however, not very much of it exceeds 4,000 feet above the snow-line. This, indeed, rather overstates the case. We find practically that the effective feeding-ground, that which gives birth to glaciers, which protrude for some distance below their supply-basins, may be placed about 1,000 feet above the ordinary snow-line; so that the glacier-generating region of Switzerland may be regarded as equivalent to a mountain district with passes about 1,500 feet, and peaks not often exceeding 3,000 feet. It follows, then, that if the temperature at the seacoast in North Wales were 32°, the whole of the Scotch Highlands, and a large part of the Cumbrian and Cambrian Hills, would become effective feeding-grounds, and the glaciers would be able to descend into the plains. In the Alps, the larger glaciers terminate at present at altitudes of from 4,000 to 5,500 feet (approximately); that is, they descend on an average about 4,000 feet below the effective feeding-ground, or 3,000 feet below the snow-line. If the temperature of Bangor were not higher than 32°, then the Snowdonian district would be comparable with one of the Alpine regions where the mountains rise generally from about 1,000 to 3,000 feet above the snow-line; that is, with such a one as the head of the Maderanerthal, where none of the peaks reach 12,000 feet above the sea. Here the Hüfi Glacier leads to passes rather below 10,000, among peaks of about 11,000 feet in altitude, and it terminates a little above 5,000 feet;

that is to say, a region, rising roughly from 2,000 to 3,000 feet above the snow-line, generates a glacier which descends more than 2,000 feet below it.

But what change is required to give a glacial epoch to Switzerland? It is generally agreed that an ice-sheet has enveloped the whole of the lowland region between the Alps and the Jura. Let us assume, that, other conditions remaining the same, this could occur if the mean annual temperature of this lowland were reduced to 32°. Its present mean temperature varies somewhat; for instance, it is 45.86° at St. Gall, 49.64° at Lausanne. Let us take 47.5° as an average, which is very nearly the mean temperature of Lucerne.[1] So this lowland requires a fall of 15.5°. We may take the average height of the region as 1,500 feet above the sea. If, then, we begin the effective gathering-ground at 1,000 feet higher, the valley of the Reuss from well below Wasen, and the valley of the Rhone from a little above Brieg, would be buried beneath *névé:* so that probably a fall of 16° would suffice to cover the lowland with an ice-sheet, and possibly bring its margin once more up to the Pierre-à-bot above Neuchâtel; at any rate, a fall of 18° would fully suffice, for then the mean temperature of Geneva would be slightly below 32°.

The line of 41° passes through Scandinavia a little north of Bergen. If, then, the climate of Norway were lowered by the same amount, which also is that suggested for Britain, the temperature at this part of the coast would be 23°, corresponding with the present temperature of Greenland rather south of Godhavn, and probably no part of Norway would then have a higher mean temperature than 26°.

The wants of North America are less rather than greater; though, as geologists affirm, an ice-sheet formerly buried all the region of the Great Lakes, and descended at one place some fifty leagues south of the 40th parallel of latitude. Its boundary was irregular; but, if we strike a rough average, it may be taken as approximately corresponding with the present isotherm of 50°. The temperatures, however, in North America fall rather rapidly as we proceed northwards. Montreal is very nearly on the isotherm of 45°, and this passes through the upper part of Lakes Huron and Michigan; that of 39° runs nearly through Quebec and across the middle of Superior; while at Port Arthur, on the same lake, the temperature is only 36.2°. If, then, we assume sufficient precipitation, the maximum fall of temperature required for this North American ice-sheet will be 18°; but less would probably suffice, for the district north of the St. Lawrence would be a favorable gathering-ground. This would be brought within the isotherm of 32° by a fall of 12°, or, at most, of 18°.

It seems, then, that if we assume the distribution of temperature in the northern hemisphere to have been nearly the same as at present, we require it to have been lowered, at any rate in the regions named, by about 18°, in order to bring back a glacial epoch. For North Wales a reduction of about 20° might be needed; but, if the isotherms ran more nearly east and west, 18° for the Thames valley might suffice. If we assume the great extension of glaciers in central and north-western Europe to be contemporaneous with that in America, we must suppose that these parts of the northern hemisphere had a climate more nearly resembling, but even colder than, that which now prevails in the southern hemisphere. The isotherm of 40° runs a little to the south of Cape Horn: that of 45° passes north of the Straits of Magellan. The latter lie on parallels of latitude corresponding with those of North Wales, but their mean temperature is about 8° lower. If we could restrict ourselves to the British Isles, it would be enough to assume a different distribution of temperature from that which now prevails on the globe, for at the present time, and in the northern hemisphere, the isotherm of 32° twice comes down very nearly to the latitude of London; but it may be doubted whether this alone would account for the great extension of the Alpine glaciers, and the difficulties seem yet greater in the case of North America. Here, where even at present the temperature is rather abnormally low, we have to make a very considerable reduction. But this is too wide a question to discuss at the end of an article in these pages. We seem, however, fairly warranted in concluding that, whatever may have been the cause, a lowering of temperature amounting to 18°, if only the other conditions either remained constant or became more favorable to the accumulation of snow and ice, would suffice to give us back the glacial epoch.

T. G. BONNEY.

[1] St. Gall, 45.86° F.; Berne, 46.58°; Lucerne, 47.48°; Zurich, 48.20°; Neuchâtel, 48.74°; Geneva, 49.46°; Lausanne, 49.64°. St. Gall and Berne are rather high stations, the one being 2,165 feet, the other 1, [illegible]. The lake of Lucerne is 1,437 feet above the sea.

A NEW DEPARTURE IN DEAF-MUTE EDUCATION.[1]

THE attention of instructors of the deaf and their friends has in various ways within the past few months been called to a proposal, very briefly outlined in the annual report of the Columbia Institution, for the enlargement of the facilities for normal training already existing in this college.

Misapprehensions have naturally arisen as to what was proposed, because, in the absence of any official utterance, unauthorized persons have taken it on themselves to publish conclusions based purely on presumptions, or, in some instances, on incomplete statements and perverted inferences.

As the plans of our directors for the "new departure" are now measurably complete, final action having been only reached in a meeting of the board held this day, I take pleasure in announcing that the teaching force of our institution will be increased next year by the employment of an experienced instructor in articulation, who will be especially devoted to the promotion of speech and lip-reading in the college.

Liberal provision has recently been made for this object by Congress.

The directors have to-day established six normal fellowships, of the value of five hundred dollars each per annum, to which graduates of colleges will be appointed for one year. These fellows will be required to reside in the institution, and will receive instruction in both the manual and the oral methods of teaching the deaf. They will, in view of the advantages to inure to them from these fellowships, be expected to perform certain duties in the institution, and will therefore constitute a distinct addition to its teaching force.

The funds for sustaining these fellowships are at the disposal of the board from sources other than the treasury of the United States.

The suggestion of establishing these fellowships, with a view of training instructors of the deaf of the highest grade, is taken from the arrangement existing in the Johns Hopkins University at Baltimore, from the ranks of whose fellows college professors, principals of high schools, and other instructors of high rank, are drawn in large and increasing numbers.

JOHNS HOPKINS UNIVERSITY,
BALTIMORE, MD., March 5, 1891.

Dr. E. M. GALLAUDET,
President National Deaf-Mute College.

Dear Sir,— I am very much interested in what you have told me of your plans and hopes for the development of the National Deaf-Mute College. Particularly it seems to me wise that you should give prominence to the fact that articulation is taught, by designating a competent instructor who should have a specific title indicating that he performs this service. I am even more interested in what you say of the possibility of enlisting annually half a dozen or more men in the service of the college, who would not only be valuable assistants during their residence with you, but would be trained for permanent careers in the various institutions of the land. Such a system here has been most fruitful in good results, and I can easily foresee how a carefully chosen staff of associates or fellows in the National Deaf-Mute College, holding an intermediate position between the permanent members of the faculty on the one hand, and the students on the other, would inspire the teachers, help the scholars, and furnish, in time, a corps of instructors for the schools for the deaf, which now exist in such considerable numbers throughout the country.

Yours sincerely,
D. C. GILMAN.

The above letter from President Gilman had much weight with our directors in their deliberations to-day.

[1] Circular of Information issued by the National Deaf-Mute College, Washington, D.C., March 7, 1891.

The advantages to the profession of deaf-mute instruction in this country, growing out of the normal fellowships now established, are many and obvious.

First of all, opportunities will be furnished to schools for the deaf to secure the services of young men and women possessed of all their faculties, of the highest education and character, with a knowledge of the natural language of the deaf, and capable of teaching by either the manual or the oral method, as circumstances may require.

These young teachers will have had not only good academic and collegiate training, but also, besides all they will gain at Kendall Green, at least a year's residence in Washington, where valuable opportunities are found for culture in the public libraries, museums, legislative halls, courts, and many other places where contact with men of high attainments is possible.

In our "new departure" the training of "deaf teachers of the deaf" will have its proper share of attention, but not that position of exaggerated importance to which it has been assigned by certain persons who have been self-appointed to speak for the college.

Those of our own students whom it may seem wise to encourage to become teachers will have all needed help in their laudable endeavor; and it is believed that the future will show, as the past has done, many of our graduates doing as good and as useful work in the instruction of their fellow deaf-mutes as can be accomplished by the best hearing and speaking instructors.

In closing this circular, the writer desires to say that the plans for increasing the usefulness of the college herein unfolded are precisely those that have been in his mind for many months, having suffered no modification by recent events.

It did not seem best to give them to the public until the ability to carry them into effect existed.

They are now communicated in the hope that they will be accorded the sympathy, the approval, and the co-operation of instructors of the deaf of all methods, of the deaf themselves, and of those friends of the cause of deaf-mute education who believe in trying to attain the greatest possible good for the greatest possible number.

EDWARD M. GALLAUDET,
President.

NOTES AND NEWS.

A PRESS despatch from Panama states that the United States Fish Commission steamer "Albatross" arrived at that port on Feb. 17, eighteen days from San Francisco *via* Acapulco. She went there to meet Professor Agassiz, who arrived from New York on the "Newport," and under his direction will make a scientific cruise in tropical waters. The area under investigation comprises the Gulf of Panama, the Galapagos, and thence to Acapulco.

— An interesting paper on the destruction of wolves in France appears in the current number of the *Revue Scientifique*, says *Nature* of Feb. 12. The law in virtue of which rewards are given for the killing of wolves was passed on Aug. 3, 1882, and during the last four months of that year 428 were destroyed. In 1883 the number killed was 1,316, the sum paid in rewards being 104,450 francs. The number was 1,035 in 1884, 900 in 1885, 760 in 1886, 701 in 1887, 505 in 1888, 515 in 1889. The departments in which most animals have been slain are Dordogne and Charente. It is believed that very soon no specimens will be left in France except those which occasionally reach it from neighboring countries.

— During the present season, according to *Nature* (Feb. 19), an attempt is to be made to extend our knowledge of the wild tribes inhabiting the borderland of Burmah, between Bhamo and the Chinese frontier on the one hand, and between the Northern Shan States and the Chinese frontier on the other. Lieut. Daly, superintendent of the Northern Shan States, and Lieut. Eliott, assistant commissioner, will spend the greater part of the next six months exploring these regions. The former will have with him an escort of fifty men of the military police, and will be accompanied by Mr. Warry of the Chinese Consular Service, and Lieut. Renny Tailyour of the Survey Department. He starts from Lashio, and will visit the states on the Salween, including the important state of Kyaingyanyi, and will then return along the supposed Chinese border, ascertaining its situation as accepted on the spot, and the nature of the country and the tribes inhabiting it. Mr. Eliott will start from Bhamo, and will be accompanied by Major Hobday of the Survey Department. These officers also will be supplied with an escort of military police. They will probably proceed up the right bank of the Irrawaddy to the bifurcation of the river, and then will cross and examine the country on the Chinese border on the left bank. The country is practically unknown at present, and it is expected that much information of an interesting nature will be collected by the exploring parties. The explorers will, of course, confine their attention to the British side of the border, and, when the time comes for the formal demarcation of the frontier by a joint commission of Chinese and British officials, the information now to be collected will, no doubt, prove useful.

— The *Journal of the Society of Arts* (London) states that the production of wine in France for the year 1890 amounted approximately to 27,416,000 hectolitres, or 603,000,000 gallons, — a proportion of 330 gallons to each hectare of land (a hectare is equivalent to 2.47 acres) under vine-cultivation. This shows an increase of 92,000,000 gallons over 1889, and a falling-off of 50,000,000, when compared with the average production of the last ten years. The increase is observable in 45 departments. *Per contra*, a falling-off was noticed in 31 departments. Viticulturists appear to have employed, as compared with 1889, much larger quantities of low-class sugars to improve the quality of their products, or to increase the yield. The quantity of wine declared for sweetening, which amounted in the first ten months to 19,561,618 kilograms, exceeded, in the period ending Oct. 31, 1890, 32,000,000 kilograms. It was necessary, as usual, to have recourse to large importations of foreign wines. During the first eleven months of last year, the quantity purchased from abroad amounted to 219,000,000 gallons. Spanish wines figured in the list to the extent of 150,000,000 gallons; Italian, 396,000; Portuguese, 4,180,000; Algerian, 38,000,000; and Tunisian, 198,404. In Algeria, wine-cultivation continues to make progress. The area under vines has increased by 3,699 hectares, in 1890; and the yield amounted to 62,568,000 gallons in that year, as compared with 55,264,000 gallons in 1889. As regards cider, the yield in France, in 1890, exceeded that of 1889 by 162,000,000 gallons, and only falls short of the average production of the last ten years by 24,000,000 gallons. In Brittany and Picardy the yield was generally greater than that of an average year; in Normandy it was not so good, and the same remark applies to Mayenne and La Sarthe.

— Among the appropriations made by the Sundry Civil Bill passed at the close of the last session of Congress are the items, aggregating $430,000, for the purchase of the Butler and Richard buildings for the use of the United States Coast and Geodetic Survey of the Treasury Department. The survey has occupied the latter building as an office since its erection in 1872, also one tenement (of the three) of the Butler building; but the increased demand for charts has rendered it necessary to greatly enlarge its printing-plant by the addition of more presses, etc. The triangulation, astronomical, magnetic, gravity, levelling, tidal, and sounding records, and the original maps of the survey, form a very valuable collection, both for reference and for comparative study. These have been steadily accumulating until they have reached such a magnitude that it has been almost impossible to handle the current work of the office. The Weights and Measures Office is also included in this bureau, and, as science advances, the demand for increased accuracy keeps pace with it; and this office is called upon to verify for colleges, manufacturing firms, and many other business institutions, as well as for the government bureaus and the several States, weights and measures of many and diverse descriptions. The question of space has long been a serious drawback and hinderance to the ready prosecution of the work intrusted to it. The bureau has reason to be congratulated upon the acquisition of a home which belongs to the government, and not being longer dependent upon landlords for keeping in repair even the roof over its head. The property ac-

quired by the government by this purchase lies directly south of the Capitol grounds, on the brow of the hill, and is not only valuable now, but is likely to increase rapidly, both on account of its commanding position and its proximity to the Capitol.

— If the statements in a communication to the Académie des Sciences by M. Lippmann are substantiated, another step towards the solution of the problem of photographing objects in their natural colors has been made. M. Lippmann's method is remarkably simple, and makes use of the ordinary re-agents. The sensitive film during exposure, as stated in *Engineering* of Feb. 20, is floated on the surface of mercury. Suppose, now, a ray of blue light, for instance, strikes the sensitive film: it will pass through, and, being reflected from the surface of the mercury behind, will pass out through the film again, interfering on its way with the incident ray. When the two rays are in the same phase, their effects will be additive, and the sensitive matter in the film will be strongly acted on. At a small distance further on, the two rays will neutralize each other, so that the film is there totally unacted on. In this way the thickness of the film is divided up into layers, on which the light has acted, half a wave-length apart: and hence, when fixed and dried, it may be considered as consisting of a number of thin plates, of the half the wave-length of blue light in thickness, and will therefore give rise to a blue color when seen by reflected light, just as the thickness of a soap-bubble gives rise to the colors seen in it. Such is a general sketch of the process as described by M. Lippmann, who adds, however, that the sensitive silver salt, iodide, bromide, or whatever else may be used, must be distributed throughout the film in an almost infinitely divided state, and in a perfectly continuous manner. The film itself must be transparent. Owing to the fact that the thickness of an ordinary film is many times the wave-length of a ray of light, the colors obtained are said to be remarkably brilliant. They are, moreover, perfectly fixed; and the prints have been exposed both to a powerful electric arc light and to bright daylight without any signs of fading. It should be added, that, if the prints are viewed by transmitted in place of by reflected light, each color is replaced by its complementary one.

— The following details regarding the work reported by the United States Hydrographic Office will be of interest: The dangerous obstructions to navigation off Barnegat caused by the wrecks of the Spanish steamship "Vizcaya" and the American schooner "Cornelius Hargraves" were removed by the United States steamship "Yantic" (Commander C. H Rockwell, U.S.N., commanding) on Jan. 29. There were thirteen fathoms of water over the steamer, which lay on her beam ends. Her two iron masts and one of the wooden ones were broken off close to the deck; the fourth (wooden) was afloat, with the heel about ten feet above water, and head held down by the rigging. The "Hargraves" was found to be nearly upright. Of her four large masts, the fore was standing erect, the topmast fidded and secured with massive wire rigging. The second mast was broken off near the deck, and was floating with the lower part above water, and surrounded by a mass of floating wreckage attached by rigging. The third mast was also intact, like the first, and connected with the hull by the rigging. The fourth was not visible. The massive wire rigging was first cut from the mastheads and towed clear of the hull, so as not to interfere with lowering the torpedoes. This duty was performed by a party under the direction of Lieut. Richman, assisted by Lieuts. Mertz and Rose, Ensign Bristol, and Boatswain Sutton. The work was successfully accomplished, after some delay on account of thick fog. Torpedoes were carried out, attached to mast-hoops on the mast of the "Hargraves," sunk to a depth of twelve and a half fathoms, so as to rest on her deck, and exploded. The mast was broken off close to the deck, and came to the surface, with a portion of the deck-house or cabin. In a similar way the other masts of the schooner and steamer were attacked and blown out, and on the morning of the 30th the work was so far completed that careful soundings taken in the vicinity showed nowhere a depth of less than thirteen fathoms, with no obstruction visible. The "Yantic" received orders on Feb. 10 to cruise along the coast from Sandy Hook to Charleston, S.C., and to destroy, as far as practicable, all abandoned wrecks dangerous to navigation.

— Between electricity, which turns night into day, and in other ways fulfils the duty of a city full of policemen, and photography, which disseminates the features of the convict far and wide, the times are not so auspicious for the burglar as they used to be. A citizen of Toledo, O., is accredited by the *Boston Transcript* with an invention by which an instantaneous photograph of an incoming burglar can be made by the flash-light camera that has been previously set and focused toward the door in such a way as to take in the entire figure of the intruder. The essential features of the device are a camera and a flash-light arrangement, in which is provided mechanism to strike a match, that ignites the flash-powder. Simultaneously with the flash a pivoted spring shutter is moved so as to cause instant exposure on the sensitive plate, and the work is done. As the burglar opens the door and steps on a prepared mat, an electrical connection is made, and a lively greeting rings out from the alarm-bells. The burglar may retreat as hastily as he pleases, but the photo flash-light has been too quick for him, and his image is left behind.

— From the official report of the Japanese census, taken on Dec. 1, 1889, it appears that the number of houses in the whole of Japan is 7,840,872, and the total population 40,702,020. The above population divided according to classes gives the following results, as we learn from *Nature* of Feb. 19: nobles and their families, 3,825; old military class, 1,993,637; common people, 38,074,558. These figures, compared with the census taken in 1888, show an increase of 38,046 houses, and of 464,786 persons. Statistics of ages are also given; and from them it appears that at the close of 1889 there were 65 persons who had attained their hundredth year in Japan, 45 their hundred and first year, 13 their hundred and second year, 11 their hundred and third year, 1 his hundred and fourth year, 9 their hundred and fifth year, 3 their hundred and sixth year, 1 his hundred and seventh year, and 1 his hundred and ninth year. The cities and prefectures having populations of over a million numbered 15, that of Tokio being given at 1,138,546; but this includes not only the city, but also a considerable administrative area around.

— D. C. Heath & Co., Boston, have just published a map of Palestine, prepared in outline especially for the use of Sunday-school teachers and classes. The same firm have in press for early publication, in their Modern Language Series, an edition of Eichendorff's "Taugenichts," with notes by Professor Osthaus of Indiana State University; also a volume containing "La Derniere Classe," "La Siege de Berlin," and "La Mule de Pape," — three ingenious stories from the pen of that clever writer, Alphonse Daudet, with notes by Professor Sanderson of Harvard.

— The Milton Bradley Company of Springfield, Mass., have recently published a manual for teachers which is of more than ordinary importance. It is entitled "Color in the School-Room," and, besides a hundred pages devoted to the theory and practice of color-teaching, it contains nearly the same number of pages of colored papers prepared for primary instruction. The selection of colors given includes the six spectrum standards, with intermediate hues between each two standards, and a miscellaneous selection of the tints and shades of the standards and various combinations of them. Each tint, shade, or combination is given a name corresponding with its color-value; as, for instance, "red tint No. 1," "red shade No. 2," "yellow-green shade," etc. This method, though it will not supersede the one in common use, is doubtless the best that can be devised for the purpose intended, as it gives a compact system of nomenclature well adapted to the needs of both teacher and pupil, each name at once suggesting its proper place in the color scheme. In the text there are chapters on the necessity of color-teaching in primary schools, color definitions, color-blindness (which, in some instances, is only color ignorance), the theory of light and color, a standard of color, how to utilize the spectrum as a standard of color, the use of rotating color-disks, the demand for a definite color nomenclature, the proper combination of colors, the Bradley scheme of colored papers, colored paper in the school-room, and water-colors in the school-room.

SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES

PUBLISHED BY

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SCIENCE IN NEW ZEALAND.[1]

WHEN I rashly replied in the affirmative to the cablegram which I received from our secretary in Melbourne, asking me to undertake the honorable and responsible duties which I have to commence this evening, I fear I did not fully realize the difficulties of the position; but since then the sense of my unfitness for the task has become very oppressive. To address an assembly of this kind on general science must involve unusual difficulties, owing to the audience being largely composed of those who, only taking a casual interest in scientific discussions, look chiefly to the results; while, at the same time, there are present professional specialists in almost every branch of knowledge. I feel that on this occasion I must be ruled by the interest of the majority, and claim the forbearance of my fellow-workers in science if I have to refer in a sketchy way to subjects in which they are deeply interested, and far more learned than I profess to be.

Seeing that I am addressing a Christchurch audience, I hope I may be permitted, in the first place, to say a word concerning one whose scientific services should, without doubt, have obtained for him the position of first president in New Zealand of the Australasian Association. We naturally recall the name of Sir Julius von Haast on this occasion, and mourn for the loss the colony has sustained of one who for thirty years occupied a most prominent position. His early researches in the North Island, in company with Von Hochstetter, were followed by the exploration of the remote districts on the west coast of Nelson, after which Canterbury secured his distinguished services, and enabled him to leave that monument of his varied scientific knowledge, shrewd capacity, and indefatigable industry, which is to be found in the Canterbury Museum.

There are others of our fellow-colonists whose wide range of experience would have peculiarly fitted them to act as your president; and I am able to say, that, had our veteran colonist and explorer Sir George Grey felt more assured in health and strength, it would have been your pleasure this evening to listen to a flood of eloquence on all scientific topics that relate to the future development of Australasia. There is another name I feel must be mentioned as one who should have been in this position had his health permitted. I refer to the Rev. William Colenso, who is not only the greatest authority on the folk-lore of the Maoris, on whom he was among the first to confer a printed literature in their own language, but whose long-continued work as a field naturalist, and especially as a botanist, is exceedingly interesting, seeing that it forms a connecting link that has continued the early spirit of natural-history research in New Zealand, that commenced with Banks and Solander, and was continued by Menzies, Lesson, the two Cunninghams, and Sir Joseph Hooker, prior to the arrival of colonists. Thus we still have in my esteemed friend, Mr. Colenso, an active veteran naturalist of what we may call the old school of explorers.

It is wonderful to reflect that little more than fifty years ago this European colony was represented by a few fishing hamlets on the seaboard of a country occupied by a considerable native population. To the early explorers, and even down to a much later date, the obstacles that beset their path were very different from those of the present time,— often obstructive natives, no roads, no steamers, no railways. Had an association then existed, and desired to promote science by giving our visitors an opportunity of visiting the remote parts of the islands, the same excursions which have on this occasion been planned to occupy a few days, would have occupied as many months, and then be accomplished only with great hardship and difficulty. I must ask the young and rising generation of colonial naturalists to bear this in mind when they have to criticise and add to the work of their predecessors. Such names of early colonists as Bidwill, Sinclair, Monro, Mantell, Travers, and may others, should ever be held in esteem as those who, amidst all the arduous trials of early colonization, never lost sight of their duty towards the advancement of science in New Zealand. I will not attempt to particularize other names from among our existing, and, though small in number, very active, corps of scientific workers. They are here, or should be, to speak for themselves in the sectional work; and I have no doubt some of those who did me the great honor of placing me in my present position are secretly congratulating themselves that they have secured for themselves the position of free lances on this occasion.

This is now the third annual gathering of this association, and New Zealand should feel honored that it has at so early a date in the association's history been selected to the turn in rotation as the place of meeting among so many divisions of the great colony of Australasia. The two volumes of the "Transactions" of the association, already in the hands of members, are quite sufficient to prove that the hopes of its founders — or, rather, I may almost say, the founder, Professor Liversidge of Sydney — have been amply fulfilled.

The papers read before the different sections, and the addresses delivered, have, in my opinion, to a most remarkable extent embodied information and discussions which were not likely to have been produced as the result of any of our local scientific organizations. The authors seemed to have felt it incumbent on them to place their subjects in the environment of Australasia, and not in relation to the colony they happened to represent. This, I take it, is the first truly effective step towards federation which has yet been achieved, and I trust that all our members will continue to be imbued with this spirit. Politicians should take this well to heart. Let them continue to aid all efforts that will tend to bring scientific accumulations in these colonies into a common store; so that each may discover for what purpose it has been best adapted by nature, and, by paying proper political respect in fiscal policy to one another, each may prosper to the full extent of its natural advantages. But it is not alone in the value of the papers communicated the association contributes to advance true civilization in the colonies. The face-to-face conference, the personal contact of the active workers in different lines of scientific work, must greatly facilitate the more thorough understanding of the work which has been done, and which is still undone. A vague idea, simmering in the brain of one scientist, who thinks light of it because it has no special application in his particular environment, may, by personal converse, flash into important results in the mind of another who has had the difficulties facing him, but without the happy thought occurring. It would be rather interesting for some one with leisure to endeavor to recount how many great discoveries have eventuated in this manner.

In casting my thoughts for a particular subject on which to address the association, I felt perplexed. Presidents of similar associations in the Old World, who are in constant contact with the actual

[1] Address of the president of the Australasian Association for the Advancement of Science, Christchurch, Jan. 16, 1891.

progress in scientific thought, feel that a mere recital of the achievements during their previous term is sufficient to command interest: but in the colonies most of us are cut off from personal converse with the leading minds by whom the scientific afflatus is communicated; and, in our suspense for the tardy arrival of the official publications of the societies, we have to feed our minds with science from periodical literature. But even in this respect my own current education is very defective, as I reside in the capital city of New Zealand, which has no college with a professional staff whose duty, pleasure, and interest it is to maintain themselves on a level with the different branches of knowledge they represent. I therefore decided, that, instead of endeavoring to review what had been done in the way of scientific progress, even in Australasia, it would be better to confine my remarks to New Zealand; the more so, that this is the first occasion that there has been a gathering of what must, to some extent, be considered to be an outside audience for the colony.

To endeavor to describe, even briefly, the progress made in the science of a new country, is, however, almost like writing its minute history. Every step in its reclamation from a wild state of nature has depended on the application of scientific knowledge, and the reason for the rapid advance made in these colonies is chiefly to be attributed to their having had the advantage of all modern resources ready to hand. As in most other matters in New Zealand, there is a sharp line dividing the progress into two distinct periods,—the first before, and the second after, the formation of the colony in 1840. With reference to the former period, it is not requisite that much should be said on this occasion. From the time of Capt. Cook's voyages, owing to his attractive narrative, New Zealand acquired intense interest for naturalists. His descriptions of the country and its productions, seeing that he only gathered them from a few places where he landed on the coast, are singularly accurate; but I think rather too much is sometimes endeavored to be proved from the negative evidence of his not having observed certain objects. As an instance, it has been asserted, that, if any of the many forms of the moa still survived, Capt. Cook must have been informed of the fact. Yet we find that he lay for weeks in Queen Charlotte Sound and in Dusky Sound, where all night long the cry of the kiwi must have been heard, just as now; and that he also obtained and took home mats and other articles of native manufacture, trimmed with kiwis' skins; and that most likely the mouse-colored quadruped which was seen at Dusky Sound by his men when clearing the bush was only a gray kiwi; and yet the discovery of this interesting bird was not made till forty years after Cook's visit. As a scientific geographer, Capt. Cook stands unrivalled, considering the appliances at his disposal. His longitudes of New Zealand are wonderfully accurate, especially those computed from what he called his "rated watches," the first type of the modern marine chronometer, which he was almost the first navigator to use. The result of a recent measurement of the meridian difference from Greenwich by magnetic signals is only two geographical miles east of Capt. Cook's longitude. He also observed the variation and dip of the magnetic needle; and from his record it would appear, that, during the hundred years which elapsed up to the time of the "Challenger's" visit, the south-seeking end of the needle has changed its position $2\frac{1}{2}°$ westward, and inclines $1\frac{1}{2}°$ more towards the south magnetic pole. Capt. Cook also recorded an interesting fact, which, so far as I am aware, has not been since repeated or verified in New Zealand. He found that the pendulum of his astronomical clock, the length of which had been adjusted to swing true seconds at Greenwich, lost at the rate of forty seconds daily at Ship Cove, in Queen Charlotte Sound. This is, I believe, an indication of a greater loss of the attraction of gravity than would occur in a corresponding north latitude.

The additions to our scientific knowledge of New Zealand, acquired through the visits of the other exploring ships of early navigators, the settlement of sealers and whalers on the coast, and of pakeha Maoris in the interior, were all useful, but of too slight a character to require special mention. The greatest additions to science were made by the missionaries, who, in the work of spreading Christianity among the natives, had the services of able and zealous men, who mastered the native dialects, reduced them to a written language, collected and placed on record the traditional knowledge of the interesting Maori, and had among their numbers some industrious naturalists, who never lost an opportunity of collecting natural objects.

The history of how the country, under the mixed influences for good and for evil which prevailed almost without government control until 1840, gradually was ripened for the colonist, is familiar to all. The new era may be said to have begun with Dieffenbach, a naturalist who was employed by the New Zealand Company. He travelled, and obtained much information, but did not collect to any great extent, and, in fact, appears not to have anticipated that much remained to be discovered: for his conclusion is, that the smallness of the number of the species of animals and plants then known — about one-tenth of our present lists — was not due to want of acquaintance with the country, but to paucity of life forms. The chief scientific value of his published work is in the appendix, giving the first systematic list of the fauna and flora of the country, the former being compiled by the late Dr. Gray of the British Museum. The next great scientific work done for New Zealand was the admiralty survey of the coast-line, which is a perfect marvel of accurate topography, and one of the greatest boons the colony has received from the mother country. The enormous labor and expense which was incurred on this survey at an early date in the history of the colony is a substantial evidence of the confidence in its future development and commercial requirements which animated the home government.

On the visit of the Austrian exploring ship "Novara" to Auckland in 1859, Von Hochstetter was left behind, at the request of the government, to make a prolonged excursion to the North Island and in Nelson; and he it was who laid the foundation of our knowledge of the stratigraphical geology of New Zealand. Since then the work of scientific research has been chiefly the result of State surveys, aided materially by the zeal of members of the New Zealand Institute, and of late years by an increasing band of young students, who are fast coming to the front under the careful science training that is afforded by our university colleges.

In the epoch of their development, the Australasian colonies have been singularly fortunate. The period that applies to New Zealand is contemporaneous with the reign of her Majesty, which has been signalized by enormous strides in science. It has been a period of gathering into working form immense stores of previously acquired observation and experiment, and of an escape of the scientific mind from the trammels of superstition and hazy speculation regarding what may be termed common things. Laborious work had been done, and many grand generalizations had been formerly arrived at in physical science; but still, in the work of bringing things to the test of actual experiment, investigators were still bound by imperfect and feeble hypotheses and supposed natural barriers among the sciences. But science is one and indivisible; and its subdivisions, such as physics, chemistry, biology, are only matters of convenience for study. The methods are the same in all, and their common object is the discovery of the great laws of order under which this universe has been evoked by the great supreme Power.

The great fundamental advance during the last fifty years has been the achievement of far-reaching generalizations, which have provided the scientific worker with powerful weapons of research. Thus the modern "atomic theory," with its new and clearer conceptions of the intimate nature of the elements and their compounds that constitute the earth and all that it supports, has given rise to a new chemistry, in which the synthetical or building-up method of proof is already working marvels in its application to manufactures. It is, moreover, creating a growing belief that all matter is one, and reviving the old idea that the inorganic elementary units are merely centres of motion specialized in a homogeneous medium; and that these units have been continued on through time, but with such individual variations as give rise to derivative groups, just as we find has been the case in the field of organic creations. The idea embodied in this speculation likens the molecule to the vortex ring which Helmholtz found

must continue to exist forever, if in a perfect fluid free from all friction they are once generated, as a result of impacting motion.

There is something very attractive in the simplicity of this theory of the constitution of matter which has been advocated by Sir William Thomson. He illustrates it by likening the form of atoms to smoke-rings in the atmosphere, which, were they only formed under circumstances such as above described, must continue to move without changing form, distinguished only from the surrounding medium by their motion. As long as the original conditions of the liquid exist, they must continue to revolve. Nothing can separate, divide, or destroy them; and no new units can be formed in the liquid without a fresh application of creative impact.

The doctrine of the conservation of energy is a second powerful instrument of research that has developed within our own times. How it has cleared away all the old cobwebs that formerly incrusted our ideas about the simplest agencies that are at work around us! How it has so simplified the teaching of the laws that order the conversion of internal motions of bodies into phases which represent light, heat, electricity, is abundantly proved by the facility with which the mechanicians are every day snatching the protean forms of energy for the service of man with increasing economy. These great strides which have been made in physical science have not as yet incited much original work in this colony. But, now that physical laboratories are established in some degree at the various college centres, we will be expected, ere long, to contribute our mite to the vast store.

In practical works of physical research we miss in New Zealand the stimulus the sister colonies receive from their first-class observatories, supplied with all the most modern instruments of research, wielded by such distinguished astronomers as Ellery, Russell, and Todd, whose discoveries secure renown for their separate colonies. I am quite prepared to admit that the reduplication of observatories in about the same latitude, merely for the study of the heavenly bodies, would be rather a matter of scientific luxury. The few degrees of additional elevation of the south polar region which would be gained by an observatory situated even in the extreme south of New Zealand could hardly be expected to disclose phenomena that would escape the vigilance of the Melbourne Observatory. But star-gazing is only one branch of the routine work of an observatory. It is true that we have a moderate but efficient observatory establishment in New Zealand, sufficient for distributing correct mean time, and that our meridian distance from Greenwich has been satisfactorily determined by telegraph; also, thanks to the energy and skill of the Survey Department, despite most formidable natural obstructions, the major triangulation and meridian circuits have established the basis of our land-survey maps on a satisfactory footing, so that subdivisions of the land for settlement, and the adoption and blending of the excellent work done by the provincial governments of the colony, are being rapidly overtaken. Further, I have already recalled how much the colony is indebted to the mother country for the completeness and detail of the coastal and harbor charts, but there is much work that should be controlled by a physical observatory that is really urgently required. I may give a few illustrations. The tidal movements round the coast are still imperfectly ascertained, and the causes of their irregular variations can never be understood until we have a synchronous system of tide-meters, and a more widely extended series of deep-sea soundings. Excepting the "Challenger" soundings on the line of the Sydney cable, and a few casts taken by the United States ship "Enterprise," the depths of the ocean surrounding New Zealand has not been ascertained with that accuracy which many interesting problems in physical geography and geology demand. It is supposed to be the culmination of a great submarine plateau; but how far that plateau extends, connecting the southern islands towards the great Antarctic land, and how far to the eastward, is still an unsolved question. Then, again, the direction and intensity of the magnetic currents in and around New Zealand require further close investigation, which can only be controlled from an observatory.

Even in the matter of secular changes in the variation of the compass we find that the marine charts instruct that an allowance of increased easterly variation of two minutes per annum must be made, and, as this has now accumulated since 1850, it involves a very sensible correction to be adopted by a shipmaster in making the land or standing along the coast; but we find from the recently published work of the "Challenger" that this tendency to change has for some time back ceased to affect the New Zealand area, and as the deduction appears only to have been founded on a single triplet observation of the dip taken at Wellington, and one azimuth observation taken off Cape Palliser, it would be well to have this fact verified. With regard to the local variation in the magnetic currents on land and close in shore, the requirement for exact survey is even more imperative. Capt. Creak, in his splendid essay, quotes the observations made by the late surveyor-general, Mr. J. T. Thomson, at the Bluff Hill, which indicate that a compass on the north side was deflected more than 9° to the west, while on the east side of the hill the deflection is 46° to the east of the average deviation in Foveaux Strait. He adds that if a similar island-like hill happened to occur on the coast, but submerged beneath the sea to a sufficient depth for navigation, serious accidents might take place; and he instances a case near Cossack, on the north coast of Australia, when H. M. Medea, sailing on a straight course in eight fathoms of water, experienced a compass deflection of 30° for the distance of a mile.

A glance at the variation entered on the meridian circuit maps of New Zealand shows that on land we have extraordinary differences between different trigonometrical stations at short distances apart. For instance: in our close vicinity, at Mount Pleasant, behind Godley Head lighthouse, at the entrance to Lyttelton harbor, the variation is only 9° 8' east, or 6° less than the normal; while at Rolleston it is 15° 33', and at Lake Coleridge 14° 2'. In Otago we have still greater differences recorded, for we find on Flagstaff Hill, which is an igneous formation, 14° 34', while at Nenthorn, thirty miles to the north, in a schist formation, we find an entry of 35° 41'.

In view of the fact that attention has been recently directed to the marked effects on the direction and intensity of the terrestrial magnetic currents of great lines of fault along which movements have taken place, such as those which bring widely different geological formations into discordant contact, with the probable production of mineral veins, this subject of special magnetic surveys is deserving of being undertaken in New Zealand. In Japan and in the United States of America the results have already proved highly suggestive. A comparison between this country and Japan by such observations, especially if combined with systematic and synchronous records by modern seismographic instruments, would be of great service to the physical geologist.

There are many features in common, and many quite reversed, in the orographic and other physical features of these two countries. Both are formed by the crests of great earth-waves lying north-east and south-west, and parallel to, but distant from, continental areas; and both are traversed by great longitudinal faults and fissures, and each by one great transverse fault. Dr. Nauman, in a recent paper, alludes to this in Japan as the *Fossa Magna;* and it corresponds in position in relation to Japan with Cook Strait in relation to New Zealand. But the *Fossa Magna* of Japan has been filled up with volcanic products, and is the seat of the loftiest active volcano in Japan. In Cook Strait and its vicinity, as you are aware, there are no volcanic rocks; but there and southward, through the Kaikouras, evidence of fault movements on a larger scale is apparent. It would be most interesting to ascertain if the remarkable deviation from the normal, in direction and force of the magnetic currents, which are experienced in Japan, are also found in New Zealand: for it is evident, that, if they are in any way related to the strain of cross-fractures in the earth's crust, the observation would tend to eliminate the local influence of the volcanic rocks which are present in one case and absent in the other.

With reference to earthquakes also, few, if any, but very local shocks experienced in New Zealand have originated from any volcanic focus we are acquainted with, while a westerly propagation of the ordinary vibrations rarely passes the great fault that marks the line of active volcanic disturbance. In Japan, also, out of about 480 shocks which are felt each year in that country, each of

which, on an average, shakes about one thousand square miles, there are many that cannot be ascribed to volcanic origin.

There are many other problems of practical importance that can only be studied from the base-line of a properly equipped observatory. These will readily occur to physical students, who are better acquainted with the subject than I am. I can only express the hope that the improved circumstances of the colony will soon permit some steps to be taken. Already in this city, I understand, some funds have been subscribed. As an educational institution, to give practical application to our students in physical science, geodesy, and navigation, it would clearly have a specific value that would greatly benefit the colony.

Another great branch of physical science, chemistry, should be of intense interest to colonists in a new country. Much useful work has been done, though not by many workers. The chief application of this science has been naturally to promote the development of mineral wealth, to assist agriculture, and for the regulation of mercantile contracts. I cannot refrain from mentioning the name of William Skey, analyst to the Geological Survey, as the chemist whose researches during the last twenty-eight years have far surpassed any other in New Zealand. Outside his laborious official duties, he has found time to make about sixty original contributions to chemical science: such as his investigation into the electrical properties of metallic sulphides; the discovery of the fero-nickel alloy awaruite in the ultra-basic rocks of West Otago, which is highly interesting, as it is the first recognition of this meteoric-like iron as native to our planet; the discovery that the hydrocarbon in torbasic and the gas shales is chemically, and not merely mechanically, combined with the clay base; and his discovery of a remarkable color-test for the presence of magnesia and the isolation of the poisonous principle in many of our native shrubs. His recent discovery, that the fatty oils treated with aniline form alkaloids, also hints at an important new departure in organic chemistry. His suggestion of the hot air blow-pipe, and of the application of cyanide of potassium to the saving of gold, and many other practical applications of his chemical knowledge, are distinguished services to science, of which New Zealand should be proud.

In connection with the subject of chemistry, there is a point of vast importance to the future of the pastoral and agricultural interests of New Zealand, to which attention was directed some years ago by Mr. Pond of Auckland; that is, the rapid deterioration which the soil must be undergoing by the steady export of the constituents on which plant and animal life must depend for nourishment. He calculated that in 1883 the intrinsic value of the fixed nitrogen and phosphoric acid and potash sent out annually was £592,000, taking into account the wool and wheat alone. Now that we have to add to that the exported carcasses of beef and mutton, bones and all, the annual loss must be immensely greater. The proper cure would, of course, be to bring back return cargoes of artificial manure, but even then its application to most of our pastoral lands would be out of the question. I sincerely hope that the problem will be taken in hand by the Agricultural College at Lincoln as a matter deserving of practical study and investigation.

I have already referred to several great generalizations which have exercised a powerful influence in advancing science during the period I marked out for review; but so far as influencing the general current of thought, and almost entirely revolutionizing the prevalent notions of scientific workers in every department of knowledge, the most potent factor of the period has been the establishment of what has been termed "the doctrine of evolution." The simple conception of the relation of all created things by the bond of continuous inheritance has given life to the dead bones of an accumulated mass of observed facts, each valuable in itself, but as a whole breaking down by its own weight. Before this master-key was provided by the lucid instruction of Darwin and Wallace, it was beyond the power of the human mind to grasp and use in biological research the great wealth of minute anatomical and physiological details. The previous ideas of the independent creation of each species of animal and plant in a little Garden of Eden of its own must appear puerile and absurd to the young naturalists of the present day; but in my own college days to have expressed any doubt on the subject would have involved a sure and certain pluck from the examiner. I remember well that I first obtained a copy of Darwin's "Origin of Species" in San Francisco, when on my way home from a three-years' sojourn among the red Indians in the Rocky Mountains. Having heard nothing of the controversies, I received the teaching with enthusiasm, and felt very much surprised, on returning to my *alma mater*, to find that I was treated as a heretic and a backslider. Nowadays it is difficult to realize what all the fuss and fierce controversy was about; and the rising school of naturalists have much cause for congratulation that they can start fair on a well-assured logical basis of thought, and steer clear of the many complicated and purely ideal systems which were formerly in vogue for explaining the intentions of the Creator, and for torturing the unfortunate students. The doctrine of evolution was the simple-minded acceptance of the invariability of cause and effect in the organic world, as in the inorganic; and to understand his subject in any branch of natural science, the learner has now only to apply himself to trace in minutest detail the successive steps in the development of the phenomena he desires to study.

With energetic leaders educated in such views, and who, after their arrival in the colony, felt less controversial restraint, it is not wonderful that natural history, and especially biology, should have attracted so many ardent workers, and that the results should have been so good. A rough test may be applied by comparing the number of species of animals and plants which had been described before the foundation of the colony, and those up to the present time. In 1840 Dr. Gray's list in Deiffenbach's work gives the number of described species of animals as 594. The number now recognized and described is 5,498. The number of *Mammalia* has been doubled through the more accurate study of our seals, whales, and dolphins. Then the list of birds has been increased from 84 to 195, chiefly through the exertions of Sir Walter Buller, whose great standard work on our avifauna has gained credit and renown for the whole colony. The number of fishes and *Mollusca* has been much more than trebled, almost wholly by the indefatigable work of our secretary, Professor Hutton. But the greatest increase is in the group which Dr. Gray placed as *Annulosa*, which, chiefly through the discovery of new forms of insect-life, has risen from 156 in 1840, to 4,295, of which 2,000 are new beetles described by Capt. Broun of Auckland.

When we turn to botany, we find that Deiffenbach, who appears to have carefully collected all the references to date in 1840, states that the flora comprised 632 plants of all kinds, and, as I have already mentioned, did not expect that many more would be found. But by the time of the publication of Hooker's "Flora of New Zealand" (1863), a work which has been of inestimable value to our colonists, we find the number of indigenous plants described had been increased to 2,456. Armed with the invaluable guidance afforded by Hooker's "Handbook," our colonial botanists have renewed the search, and have since then discovered 1,469 new species, so that our plant census at the present date gives a total of 3,355 species.

It would be impossible to make mention of all who have contributed to this result as collectors, and hardly even to indicate more than a few of those to whom science is indebted for the description of the plants. The literature of our post-Hookerian botany is scattered about in scientific periodical literature; and, as Hooker's "Handbook" is now quite out of print, it is obvious that, as the new discoveries constitute more than one-third of the total flora, it is most important that our young botanists should be fully equipped with all that has been ascertained by those who have preceded them. I am glad to be able to announce that such a work, in the form of a new edition of the "Handbook of the Flora of New Zealand," approved by Sir Joseph Hooker, is now in an advanced state of preparation by Professor Thomas Kirk, who has already distinguished himself as the author of our "Forest Flora." Mr. Kirk's long experience as a systematic botanist, and his personal knowledge of the flora of every part of the colony, acquired during the exercise of his duties as conservator of forests, point to him as the fitting man to undertake the task.

But quite apart from the work of increasing the local collections

which bear on biological studies, New Zealand stands out prominently in all discussions on the subject of geographical biology. It stands as a lone zoölogical area, minute in area, but on equal terms, as far as regards the antiquity and peculiar features of its fauna, with nearly all the larger continents in the aggregate. In consequence of this, many philosophical essays — such, for instance, as Hooker's introductory essay to the early folio edition of the "Flora;" the essays by Hutton, Travers, and others; and also the New Zealand references in Wallace's works — have all contributed essentially to the vital question of the causes which have brought about the distribution and geographical affinities of plants and animals, and have thus been of use in hastening the adoption of the doctrine of evolution.

Much still remains to be done. Both as regards its fauna and its flora, New Zealand has always been treated too much as a whole quantity; and in consequence percentage schedules, prepared for comparing with the fauna and flora of other areas, fail from this cause. It is absolutely necessary not only to discriminate localities, but also to study more carefully the relative abundance of individuals as well as of species before instituting comparisons. The facility and rapidity with which change is effected at the present time should put us against rashly accepting species which may have been accidental intruders, though wafted by natural causes, as belonging to the original endemic fauna or flora. Further close and extended study, especially of our marine fauna, is urgently required. We have little knowledge beyond the littoral zone, except when a great storm heaves up a gathering of nondescript or rare treasure from the deep. Of dredging we have had but little done, and only in shallow waters, with the exception of a few casts of the deep-sea trawl from the "Challenger." When funds permit, a zoölogical station for the study of the habits of our sea-fishes, and for the propagation of such introductions as the lobster and crab, would be advantageous. I observe that lately such an establishment has been placed on the Island of Mull, in Scotland, at a cost of £400, and that it is expected to be nearly self-supporting. With respect to food-fishes, and still more with respect to some terrestrial forms of life, we, in common with all the Australasian colonies, require a more scientific and a less casual system of acclimatization than we have had in the past.

One must talk with bated breath of the injuries that have been inflicted on these colonies by the rash disturbance of the balance of nature. Had our enthusiasm been properly controlled by foresight, our settlers would probably not have to grieve over the losses they now suffer through many insect-pests, through small birds and rabbits, and which they will in the future suffer through the vermin that are now being spread in all directions.

HEALTH MATTERS.

Why the Stomach does not digest Itself.

FROM a new study of this subject Dr. E. Sehrwald announces the following conclusions (*Medical Record*, March 7, 1891): 1. The balance between the alkali of the blood and the acid of the gastric juice does not follow, during life, the law of diffusion, but moves in narrower limits; 2. The self-digestion of the stomach is partly prevented by the alkalinity of the blood, and partly by cell-action; 3. The living epithelium interposed between the blood and the gastric juice prevents their mutual neutralization, and preserves the alkalinity of the blood and the acidity of the gastric juice; 4. By this protection the stomach is spared a great deal of work of secretion and absorption; 5. The protection furnished by the flowing blood is partly due to its alkalinity, and partly to its properties as a nutritive liquid; 6. All influences which arrest the nutrition of the cells of the walls of the stomach may lead to self-digestion and ulceration. The conditions which may be mentioned in this connection are, first, disturbances in the circulation; second, direct injury to the epithelium; and, third, injuries of the trophic nerves.

Cremation and its Safeguards.

The *Lancet*, Jan. 31, 1891, says, "Unfortunate circumstances connected with the death of the late Duke of Bedford have brought into prominence an important question respecting the procedure of the Cremation Society, of which the late duke was a prominent member, in cases of death from other than purely natural causes. It is clear that in the case of the society absolute certainty as to the cause of death, when other than natural, can alone justify the preferential application of its method. It will therefore be interesting to examine the practical value of the safeguards adopted by the society to prevent the chances of fallacy in a matter so important. These are three: namely, (1) the certificate of the medical practitioner in attendance on the deceased during his last illness; (2) a second independent certificate by another practitioner after careful inquiry into the circumstances attending the illness; and (3), should any doubt remain, the evidence afforded by necropsy.

"A further, though possibly less permanent, security exists in the resolution of the society to refuse cremation in any case where the least doubt exists respecting the cause of death. Such doubt, as observed by Sir Henry Thompson, could remain after necropsy only in an extremely small number of cases, and would, in fact, be virtually abolished. Not actually so, however. There still remains a minimum uncertainty; and this, it is apparent, is much greater where certification, even on the very careful system employed by the society, is alone relied upon. The practitioner in attendance might, in spite of diligence and skill, be misled; for example, in a case where the signs of poison were obscurely blended with those of real or supposed disease. In this connection the case of the late Mr. Maybrick is suggestive. Is it, then, to be believed that a second medical testimony, which would be independent of the former, could be relied on to guarantee the difference of opinion which would necessitate an appeal to the coroner? We should rather expect that this latter evidence, divested as it must be of various technical premises which guided the statements in the first certificate, would be at best a carefully weighed and usually confirmatory assertion of moral certainty.

"After all, it is probable that the most reliable safeguard against a too precipitate practice of cremation which we possess is to be found in the resolutions of the society above mentioned. Cremation, therefore, under its present rules, is certainly a valuable means of promoting accuracy in certification. As affording an absolute guaranty of such accuracy, it cannot be depended on, while it must in all cases destroy every trace of morbid or mischievous agency contained in the tissues. While, therefore, we freely admit its practical security against any miscarriage of justice in the vast majority of cases, we cannot admit that it stands in this respect on a level exactly so high as the practice of burial. Moreover, while we also recognize its more absolute and destructive purity in the disposal of infectious dead, we do not see that it possesses any such advantage in comparison with burial in other cases, provided that burial be conducted, as it increasingly is conducted, on a rational or 'earth to earth' system."

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

The Motion of Storms and High Areas.

THERE was presented in this journal Feb. 27 a short discussion of the origin and motion of waves of heat and cold. I desire to still further discuss this question under an analogous heading. In the previous note it is possible that too much prominence was given to the occurrence of temperature falls in the rear of storms when there were no high areas near. These falls seem to be accompaniments of storms, but are of very limited extent and slight intensity. They seem to be due largely to radiation from the air and earth to the clear sky.

It may conduce to clearness if several propositions are advanced and discussed.

1. *Storms and High Areas have the Same Velocity.*— If this were not so, the one would overtake the other when they were moving along the same line. Of course, there may be such conditions on any map, in different lines, which have widely different velocities.

2. *These Conditions extend far above our Highest Mountains.*— We find the fluctuations of air-pressure on the advance of these conditions the same at mountain stations as at the base, except that the changes occur later at the summit, for reasons which have been fully set forth in the "Report of the Chief Signal Officer for 1882." The temperature changes, both the rise on the advance of a storm and the fall in its rear, after the diurnal range has been eliminated, are greater on a mountain than at the base, and they occur several hours earlier at the summit. The form which a storm or high area assumes is that of a disk with a height of five to ten miles, and a diameter of one thousand, and it may extend to the limits of the atmosphere.

3. *There is no Marked Movement of Air or Moisture-Particles by Heated Currents from the Earth upward.*— The best proof of this, perhaps, is in the fact that the velocity of the horizontal currents is markedly increased as we rise in the atmosphere, and hence such a movement would be rapidly disintegrated and brought to nought.

4. *There is no Whirl in Either of These Conditions a Few Thousand Feet above the Earth.*— Observations on Mount Washington (6,300 feet) have shown this fact. Unfortunately we have not the data to show just how high the gyratory circulation which we observe at the earth's surface extends, but the limit is probably 3,000 feet. This fact is a most important one to determine, and there is no better region to establish it on the whole earth than the isolated mountain-peaks of New England. Greylock, Ascutney, Killington, Mount Washington, Green Mountain, and a score of others, are all situated right in the path of our storms and high areas, and, it is believed, are destined to aid most materially in solving the riddles which now confront us on all sides.

5. *Their Motion is Independent of the Wind.*— To those familiar with weather science this will be self-evident, but it may be well to simplify this proposition slightly. Let us consider the case of a storm condition moving at thirty miles per hour between two points (*A* and *B*) six hundred miles apart. Let the wind have a velocity of fifteen miles per hour. In twenty hours the exact changes of the wind, pressure, temperature, etc., which took place at *A* will take place at *B*, provided the storm remains constant; but if we had put in the wind at *A* a bit of cotton, or some substance which would go exactly with the wind, at the moment the storm-centre was at *A*, we would have found it just half way between *A* and *B* at the moment the storm-centre crossed *B*. This shows plainly that all the conditions which accompany a storm are practically independent of the wind. The wind blows cold, but it is because a cold wave has passed that way. This may be made still clearer by considering an enormous sphere a thousand or two thousand feet in diameter, and highly heated, at a few thousand feet above the earth. If this were stationary, our thermometers, if delicate enough, would show its pressure, and the wind would transport the heat at its velocity; though it is evident that there would be an exceedingly rapid dissipation of this heat if there were no method of renewal. Suppose this sphere were transported horizontally at thirty miles per hour, and its heat could affect our thermometers instantly: it is evident that there would be a miniature warm wave travelling across the country at thirty miles per hour; but this would be independent of the wind, though it would have a tendency to modify that.

6. *Their Motion is Independent of Air-Currents at any Elevation.*— This proposition will be the most difficult of all to accept, and yet it seems to be abundantly borne out by the facts. During the passage of a storm, the air-current gradually increases in velocity as we rise in the atmosphere. After a certain height is reached, the velocity of this current is diminished. Again, during the passage of a high area the velocity of the current itself is markedly diminished, and, as I have shown, it is half that of the high area at the height of Mount Washington, while during the passage of a storm it is nearly double the storm velocity. Now, it is plain that any condition having any height in the atmosphere would be entirely disintegrated by the varying velocity of the different strata of the atmosphere; and also its motion cannot be due to that of the strata, since this velocity is far greater than that of the storm, and is only half that of a high area. It has also been shown that the direction of motion of storms and high areas is very different from that of the strata far above the earth. One other consideration may be presented. It frequently occurs that storm conditions seem to be transferred through the air without a corresponding depression at the earth's surface, and at a velocity which appears to be far higher than the air strata can have.

This whole subject is exceedingly complicated; and it must be confessed that we must continue to grope rather in the dark until we can obtain the facts which shall enable us to lay the first stone of a consistent theory of these conditions, which are so familiar to us, but of which we know next to nothing. I cannot do better than to close this discussion, without further comment, with the remarkable views of two specialists eminent in this line of research. These views are entirely at variance with the facts observed in this country, and cannot possibly be accepted as an explanation of the phenomena in question. I have already shown, that, owing to the peculiar position of European mountains far to the south-east of the path of storms, we can hope for but little assistance from observation at their summits in elucidating these complex problems.

Dr. J. Hann of Vienna, in a recent publication, has said, "The forces which are in activity in the winter in the air circulation of the higher latitudes arise from the heat of the tropics; that is, from the heat difference between the polar regions and the equatorial zone. Storms and high areas are merely secondary phenomena in the general atmospheric circulation."

Dr. W. Siemens of Berlin has written as follows: "Minima and maxima of air-pressure (storms and high areas) are consequences of the temperature and velocity of air-currents in the higher atmospheric strata." H. A. HAZEN.

Washington, March 9.

BOOK-REVIEWS.

Constructive Steam-Engineering. By J. M. WHITHAM. New York, Wiley. 8°. $10.

THIS descriptive treatise covers pretty thoroughly a rather extensive field, embracing as it does engines, pumps, and boilers, with all their accessories and appendages. The scope of the work is limited, as indicated by the title, to constructive features, design not being discussed. But this does not lessen the value of the book, as nearly every form of engine or boiler that has won recognition in modern steam-engine practice is fully described, illustrated, and discussed. Steam-engine design, as a separate subject, was ably treated in a previous work by the same author, noticed in these columns a year or more ago.

In the preparation of this work the author has had ample resources to draw upon; and he has exercised notable discretion in sifting out essentials from non-essentials in dealing with the mass of material placed at his disposal by the current literature of the subject.

The plan of the work is as follows. A brief classification of the various types of engines comes first. This classification may be summed up as (1) condensing and non-condensing; (2) non-expansive and expansive; (3) simple, compound, triple-expansion, and quadruple-expansion; (4) single-acting, double-acting, and rotary; (5) rotative and reciprocating; (6) stationary, portable, locomotive, and marine. Less important is the further classification into (7) horizontal, vertical, inclined, and oscillating; and (8) erect vertical, inverted vertical, direct-acting, indirect-acting, and beam engines. Exception may be taken to the author's statement, in this introductory chapter, that compound, triple, and quadruple expansion engines have respectively two, three, and four cylinders. Some of them have, as shown in a subsequent chapter, at least one extra cylinder; that is, two low-pressure cylinders instead of one larger one. This, of course, is a small matter; but it would be well to classify the engine in this respect by the number of expansions instead of the number of cylinders.

The second chapter, a very important one, is devoted to heat and steam, embracing a discussion of thermometers and calorimeters. Then comes a chapter in which the constructive details of an engine are illustrated and discussed; after which comes a lucid presentation of the indicator and its uses, and a chapter on the

use, operation, and setting of the slide-valve and independent cut-off, followed by a discussion of the various forms of valve-gears, and of automatic cut-off and throttling engines. A chapter treating of compound and triple and quadruple expansion engines comes next, after which condensers, pumps, and pumping-engines are considered. Next is given a chapter on the miscellaneous attachments and minor details of an engine, embracing stop-valves, throttle-valves, and relief-valves, stuffing-boxes, belting, lubricators, etc., followed by a chapter on the management of engines and pumps, engine trials, and dynamometers.

When the subject of boilers is reached, a chapter is devoted to the theory of combustion and the various types of boilers in use, and another to their constructive details and strength. The concluding chapter of the book treats of the appendages and accessories of boilers, their decay, management, etc.

At first blush, after a hasty glance through the pages of this bulky volume, the price of it would seem too great; but, after a careful examination, that impression disappears. True, the material from which the author evolved the work was abundant and ready to hand, but the illustrations alone (and they are many) "came easy." The labor of working over the material, — putting it "into perspective," as it were, effectively, discriminatingly, and judiciously, — and welding the whole together into a book suitable alike to the needs of the student, the engineer, and the miscellaneous seeker for information, must have been enormous. That the work is well done is certified to by the reputation of both author and publisher.

AMONG THE PUBLISHERS.

THE Forest and Stream Publishing Company announce a new and enlarged edition of "Fly-Fishing and Fly-Making for Trout," by J. Harrington Keene. The book has as illustrations actual specimens of the silk, feathers, and other materials used in fly-making.

— A "Flora of Palestine" is in progress, edited by the Rev. G. E. Post, and is now completed as far as the end of the order *Umbelliferæ*. Several new species are described.

— Among the contents of the *New England Magazine* for March, we note "The Early History of Electricity in America," by George Herbert Stockbridge; "Window-Gardening," by Mrs. Henrietta L. T. Wolcott; "The Indian-Corn as our National Plant," by Sarah Freeman Clarke; "The Problem of the Unemployed," by William M. Salter; and "The History of Historical Writing in America," III., by J. F. Jameson, Ph D.

—Messrs. Ginn & Co. announce "The Industrial Primary Arithmetic," by James Baldwin, Ph.D., to be published in April. This work possesses many features which distinguish it from others of its class. Theory gives place to practice. The pupils

Publications received at Editor's Office, Feb. 23–March 7.

ALABAMA Geological Survey. Report on the Cahaba Coal Field, by Joseph Squire, M.E., with Appendix on the Geology of the Valley Regions Adjacent to the Cahaba Field, by Eugene A. Smith. Montgomery, Ala., State. 189 p. 8°.

AUSTEN, W. C. R. An Introduction to the Study of Metallurgy. London, Charles Griffin & Co.; Philadelphia, Lippincott. 292 p. 12°.

BALL, R. S. Time and Tide, A Romance of the Moon. New York, E. & J. B. Young. 188 p. 16°. $1.

CARUS, P. The Soul of Man: An Investigation of the Facts of Physiological and Experimental Psychology. Chicago, Open Court Publ. Co. 458 p. 12°. $3.

DARWIN, C. On the Structure and Distribution of Coral Reefs, with an Introduction by Joseph W. Williams. New York, A. Lovell & Co. 278 p. 12°.

DIETZ, W. D. The Soldier's First Aid Handbook. New York, Wiley. 98 p. 16°. $1.25.

GAGE, A. P. Physical Laboratory Manual and Note Book. Boston, Ginn. 121 p. 12°. 45 cents.

GREEN, A. H. The Birth and Growth of Worlds. New York, E. & J. B. Young & Co. 61 p. 16°. 40 cents.

KINGS' Jester, The. Vol. I., No. 1. March, 1891. *m.* New York, Herbert Booth King & Brother. 16 p. 4°. $1 per year.

LOCK, J. B. Arithmetic for Schools. American edition. London and New York, Macmillan. 388 p. 16°. 70 cents.

MERCURY, The. Vol. I., No. 1. *w.* Halifax, N. S., Dunn Publ. Co. 8 p. f°. $2 per year.

MORGAN, C. L. Animal Life and Intelligence. Boston, Ginn. 512 p. 8°. $4.

PERRY, J. Spinning Tops. The "Operatives' Lecture" of the British Association Meeting at Leeds, 6th September, 1890. New York, E & J.B. Young. 136 p. 16°. $1.

TIDY, C. M. The Story of a Tinder-Box. New York, E. & J. B. Young & Co. 105 p. 16°. 80 cents.

U. S. NAVAL ACADEMY, Annapolis, Md., Annual Register of the, 1890-91. Washington, Government. 84 p. 8°.

WARD, H. M. Diseases of Plants. New York, E. & J. B. Young. 196 p. 16°. $1.

are taught weights and measurements by actually weighing and measuring; they are taught to buy and sell, to make change, to keep a simple system of accounts, to make bills; in short, to perform all those simpler operations in numbers which men and women in the ordinary walks of life are required to understand.

— The March *Magazine of American History* opens with a study of the public career of Gen. Francis E. Spinner the financier, by Rev. Isaac S. Hartley, D.D. The paper includes a description of Gen. Spinner's part in the conception and issue of the "greenbacks." The second article is a story, by Hubert Howe Bancroft, of his varied experiences in bringing out his first book, describing his literary pilgrimage from California to visit the notable authors of Boston and New York. In the third paper we have a sketch, with portrait, of Rev. Samuel M. Isaacs, written by his son Abram S. Isaacs, Ph.D. Following this, Mr. A. W. Clason of Virginia contributes an account of the Pennsylvania Convention, 1788. The next is a paper from the pen of Hon. Charles K. Tuckerman of Florence, Italy, entitled "An Hour with George Bancroft," in which he describes his last visit to the great historian; then comes a sonnet on the same theme, "George Bancroft, 1800–91," by William C. Richards. An article that will interest a large class of readers in all parts of the country is "Slavery in Canada," by J. C. Hamilton, LL.B. "The Homespun Age," a chapter by M. C. Williams, relates to early settlements in the interior valleys of Tennessee. "The Hunters of Kentucky," an old song, composed just after the battle of New Orleans, from W. Abbatt; the description of the frontispiece by the editor; and "Washington at Tarrytown in 1783," by M. D. Raymond,— complete the principal features of the issue.

— Under the title "Hints to Power Users," Mr. Robert Grimshaw, whose "Catechisms of the Steam Engine, Pump, and Boiler," and other practical works, have proved so popular, has prepared some non-technical advice to the men who pay the bills. It is issued by the Cassell Publishing Company, New York City.

SCIENCE

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CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

March 14. — Swan M. Burnett, A New Metric System of Numbering Prisms; J. Stanley Brown, Bernardinite: Is it a Mineral or a Fungus? J. Howard Gore, The Geodetic Operations in Russia; E. D. Preston, The Study of the Earth's Figure by Means of the Pendulum.

Women's Anthropological Society of America, Washington.

March 14.—Mrs. Christine Ladd Franklin, Intuition and Reason.

Boston Society of Natural History.

March 18.—G. Baur, The Importance of a Scientific Investigation of the Galapagcs Islands; W. O. Crosby, On the Colors of Soils.

Royal Meteorological Society, London.

Feb. 18.—C. Harding, The Great Frost of 1890-91; H. F. Blanford, On the Variations of the Rainfall at Cherra Roonjee in the Khan Hills, Assam; T. W. Blackhouse, The Problem of Probable Error as applied to Meteorology.

American Institute of Electrical Engineers.

March 17.—J. J. Carty, Inductive Disturbances in Telephone Circuits.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

A COLLEGE GRADUATE—has had four years' experience in analytical laboratory and in works—desires position in chemical works, oil refinery, or paint works, or in any position where a technical chemist is needed. Address "CHEMIST," care *Science*.

A HARVARD M.A., especially interested in Natural History, would like to learn of some outdoor occupation for the summer. Remuneration a secondary object. SUMMER, *Science* Office.

A CHEMIST, taking P. G. work in the Scientific Department of one of our best colleges, would like to negotiate for some industrial position, where his knowledge would be of avail. Can furnish best of references. R. S. W., Box 691, Amherst, Mass.

WANTED—A position to teach Electrical Engineering by a student from leading English and French and U. S. science schools, or would accept position as Consulting Electrical Engineer, Electrician, etc. Very highest testimonials London & Hartford Publishing Co., N. Y. (International Press Department.)

WANTED.—A young man in college would like a position during the summer of 1891 in some scientific work, particularly Orinthology, either as an instructor or tutor, or in making collections or accompanying some scientific expedition. Can give good references. Address HUBERT L. CLARK, Amherst, Mass.

WANTED.—A young man who has been teaching in a first-class High School desires a position in a similar institution. Is competent to teach Mathematics, Latin, Book-keeping, and the English branches. Can give highest references Address H. W. MARTHENS, 6208 Broad St., Pittsburgh, Pa.

WANTED.—A situation in a scientific house by a graduate of the scientific department of the Jersey City High School as Geologist, Mineralogist or as assistant teacher in Physics or assistant to a chemist. Best of references. E. W. PERRY, 582 Third Street, Jersey City, N. J.

WANTED.—By a medical student of three courses, a position on some war or mercantile vessel sailing between America and some foreign country, as Clerk, Assistant Physician or Druggist, or any respectable occupation. Content with a moderate remuneration. Highest commendations. W. L. S., *Science* Office.

INFORMATION WANTED.—Clarence W. Bowen, Secretary of the Committee on the Centennial of Washington's Inauguration, 251 Broadway, New York, desires information regarding the portraits of John Hathorn and Jeremiah Van Rensselaer, members of Congress from New York. These portraits, for the Memorial Volume, are particularly desired, to complete the list of portraits of the New York delegation in Congress at the time of Washington's inauguration.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

Will exchange a new Thomson reflecting astatic galvanometer, about 6,000 ohms, made by Clark, Muirhead & Co., London, and costing £30, with 1-9, 1-99, 1-999, shunts, lampand scale, for a Weston voltmeter and ammeter, or arge Wheatstone bridge, dial pattern, or a portable testing outfit. Address G. A., *Science* Office, 47 Lafayette Place, New York.

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

I have a good supply of Eastern Coleoptera which I wish to exchange for species not in my collection. Melandryidae and Oedemeridae especially desired. Joe C. Thompson, Rosebank P. O., Box 73, S. I.

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1890 Seeger and Guernsey Cyclopedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost $6. David R. Lewis, Saybrook, Ill.

SCIENCE

NEW YORK, MARCH 20, 1891.

DRAKE'S REPORT ON THE GEORGIA OYSTER-BEDS.

THE United States Coast and Geodetic Survey has recently published a bulletin (No. 19) containing a report by Ensign J. C. Drake, U.S.N., and assistant United States Coast and Geodetic Survey, on "The Sounds and Estuaries of Georgia with Reference to Oyster-Culture." The author states in his preface that he had but five months for the examination, and but a limited fund at his disposal, and makes no claim for completeness of the work done under those circumstances; nevertheless the results of the examinations appear to have satisfied all the requirements, and the people of Georgia are in possession of the information necessary for wise legislation on the oyster question; and to obtain that was the principal object of the examination.

Mr. Drake reports that he examined all the ground in any way suitable for oyster-growing, the area being some seventy thousand acres. Of this, he finds some thirty thousand acres as suitable for oyster-culture, and some forty thousand acres unsuitable. His decisions in the premises are based upon the character of the bottom and density of the water. He alludes only casually to the number and character of the predatory enemies of the oyster, which is to be regretted; nor does he give much information regarding the oysters found, beyond the fact that they are not "fat," or fit for market, until late in the year. The significant intelligence, however, is that the beds are much depleted from over-fishery.

As the State possesses only some seventeen hundred acres of natural beds, and as these are already much depleted, it is not wonderful that the Legislature desired an investigation, in the first place, and followed it up by passing a liberal law encouraging the cultivation of additional areas; and it is gratifying to learn that under this law some three thousand acres (one-tenth the available area) are already in process of improvement, for, indeed, our oyster-industry is in a sad way, and we must look to the private cultivator for the future supply. Any thing that States can do, investigation accomplish, or enterprise bring about, in this field, will be gladly welcomed by a public which has seen the price of oysters increase from twenty-five cents to fifty cents per bushel in ten years, and the ratio of increase still continuing.

Nearly twenty years ago the Coast Survey began its investigations of the oyster-beds of the country. Count Pourtales was the pioneer. He was followed by Collins and Winslow of the Navy, Bradford of the Survey, and again by Winslow. The United States Fish Commission has added also to the fund of information; and Professors Goode, Ryder, and others have made many valuable reports on the condition of the industry. The Johns Hopkins University has, in connection with the State of Maryland, published the reports and studies of Dr. W. K. Brooks, and no more valuable addition to our knowledge has been made than these reports. The States of Rhode Island, Connecticut, New York, Maryland, and North Carolina have organized commissions and surveys, and have exhaustively studied the condition of the beds, the fishery, and the general industry of their particular waters.

In the mass of literature that has come into being during the last ten years, it would be naturally expected that some differences should exist as to the condition of the beds and as to the remedy to be applied; but in the main essentials no differences do exist. All the various persons, officials, and bodies, working at different times, in different localities, and without connection, have uniformly reported that the natural oyster-beds were either extinct or fast becoming so, and that the only remedy was to encourage cultivation by private enterprise.

With such unanimity of testimony and advice, it would seem impossible that the remedy should not be applied. Unfortunately such has not been the case. It is true that a few progressive States, such as Connecticut, New York, North Carolina, and Georgia, have started on the right road; but the great oyster areas of the Chesapeake are likely to remain many years uncared for; and, while their beds are being rapidly destroyed, no provision is made to meet the enormous demand which the Chesapeake has heretofore supplied. It is possible that the legislation in North Carolina, which has been in operation several years, may have some effect by encouraging cultivation of the large tract of oyster bottom the State possesses; but, unless such cultivation is now in progress to a very considerable extent, it will not be sufficient to prevent such a falling-off of the supply as to amount to something like an oyster famine in a few years.

It would not be surprising if oysters were soon out of the reach of most people's pockets. If they do become so, we will have the consolation of knowing that we had ample warning, and the gentlemen who have conducted the investigations and made the reports for these many years can have the satisfaction of seeing their prophecies realized. The more reports we have, the better; the more extensive the investigation of the subject, the sooner will a remedy be adopted; and the community has reason to thank the Coast Survey for this last addition to our knowledge, and to congratulate Mr. Drake on his very successful prosecution of a work of so much importance.

HEALTH MATTERS.

Inoculation by Mosquitoes against Yellow-Fever.

DRS. FINLAY and DELGADO of Havana have published some statistics of their practice of inoculating persons newly arrived in Cuba against yellow-fever by means of mosquitoes which have been caused to contaminate themselves by stinging a yellow-fever patient. These observations, according to the *Lancet* of Jan. 31, have been carried on for the last ten years, and, in addition to a certain number which are still incomplete, may be said to consist of fifty-two cases of mosquito inoculation which have been fully followed up. Of these, twelve experienced between the fourth and the twenty-sixth day after inoculation a mild attack of yellow-fever, with or without albuminuria; twelve experienced no symptoms of yellow-fever either within twenty-five days after the inoculation or during three years subsequently; twenty-four experienced no symptoms within twenty-five days, but contracted a mild attack before the end of three years, either uncomplicated by

albuminuria altogether, or with only a very transient appearance of it; three who had had no symptoms within twenty-five days contracted well-marked yellow-fever within three years; one patient who had a mild attack in consequence of inoculation contracted a severe attack later on, which proved fatal: that is to say, of those who had been inoculated, only about eight per cent contracted the disease in a well-marked form, with a mortality of under two per cent. In order to enable one to appreciate the significance of these figures, the authors mention that they observed sixty-five monks who from time to time arrived in Havana, where they all lived under similar conditions. Thirty-three of these were inoculated, and thirty-two were not. Only two of the inoculated contracted well-marked attacks, which, however, did not prove fatal; whereas eleven of those that had not been inoculated were severely attacked, no less than five dying. It is remarked that inoculations performed in the cold weather are not entirely trustworthy, and that they should be followed up by a repetition in the spring.

A New Bleeding Era.

The discussion which took place at the last meeting of the Royal Medical and Chirurgical Society of London was in many respects interesting and noteworthy, says the *British Medical Journal* of Jan. 31, 1891, editorially. Dr. Pye-Smith is to be congratulated on having so effectually succeeded in directing attention to a subject which must always have a real, if even only an historical, interest.

The reflections and conclusions contained in the paper were based upon the record of some fifty cases coming under the notice of the writer, in which venesection had been resorted to. The range of diseases in which it was employed included such acute affections as bronchitis, acute broncho-pneumonia, lobar pneumonia, miliary tuberculosis of the lungs, with others of more chronic nature, such as valvular disease of the heart with pericarditis, Bright's disease, aneurism, and epilepsy. Its value in other conditions, such as hemoptysis, apoplexy, uremic coma, was also considered.

The discussion which ensued was remarkable, on account of the almost complete unanimity which the speakers expressed in favor of the adoption of this method of treatment in suitable and urgent cases. All testified to the great and immediate relief which venesection gave under such circumstances,— a relief unattended by any ill consequences on the subsequent progress of the disease.

Considerable differences of opinion, it is true, existed as to the cases most likely to be benefited by the treatment, or, rather, as to the cases which, in the experience of the various speakers, had most benefited by the treatment; for it was one of the noteworthy features of the discussion that there was a commendable absence of recourse to theoretical considerations as a basis for the practice.

In this respect the subject of venesection occupies a different position from that held by it in the former "bleeding era," to which reference was made in such humorous and instructive fashion by Sir George Humphry and Mr. George Pollock. The practice was then based on the humoral pathology which so long dominated the practice of medicine, — that pathology which ascribes disease to the presence of deleterious agents in the blood, and which seemed, therefore, to justify the withdrawal of a certain quantity of the noxious blood as one of the best ways of curing it. As Dr. Broadbent pointed out, it was because the practice had been based so entirely on theory that it was carried to excess, and fell into such disrepute.

One of the chief merits of Dr. Pye-Smith's paper and of his subsequent remarks was to lay stress on the importance of resorting to venesection; not for the cure of pathological conditions as such, but for the relief of distressing symptoms depending on temporary alterations in the physiological balance of the circulation. As to the first indication laid down for the performance of the operation,— cyanosis with distention of the right side of the heart depending on pulmonary or other obstruction to the circulation, — there was a consensus of opinion favorable to the operation; but Dr. Broadbent did well to point out, that, before resorting to venesection under such circumstances, there should be evidence, as shown by the disparity between the strength of the heart's beat and the weakness of the pulse, that the right ventricle was still acting powerfully, and able to take advantage of the relief afforded it by the withdrawal of blood.

As to the second indication,— the pain of aortic aneurism,— the cases mentioned by Dr. Pye-Smith and Mr. Hulke, in which instantaneous relief was thus given, were very striking; and evidence of its curative effect on the aneurism was also incidentally adduced by Mr. Jonathan Hutchinson. Nevertheless, as Dr. Stephen Mackenzie pointed out, it may be doubted whether, in iodide of potassium, nitrite of amyl, and nitro-glycerine, we do not possess remedial agents equally powerful and equally efficacious in relieving the high arterial tension on which such attacks of pain depend. The discussion, indeed, brought out the fact that it is in relieving pain that venesection finds one of its best applications, and more especially in relieving the intense inflammatory pain of pleurisy, pleuro-pneumonia, or the severe pain, with threatening onset of cerebral symptoms, following injury to the skull.

To those accustomed, as most now are, to regard loss of blood, from whatever source, as an unmitigated evil, the suggestion to follow up an extensive bleeding from the lungs by a further bleeding from the arm is startling. Nevertheless, something can be said, and was adduced by one of the speakers, in favor of its adoption in cases in which the patient is in urgent danger of suffocation from the reflux of blood into the bronchi. It is, however, peculiarly open to the objection brought against the operation of venesection generally,— that, in the present state of public opinion as to blood-letting, the discredit of a fatal result is too likely to be hastily assigned to the venesection. Apart from such considerations, however, the general result of an unusually animated discussion will be to direct attention once more to the possible advantages attending the judicious employment of a mode of treatment long condemned as not only useless but dangerous.

NOTES AND NEWS.

AN instrument called the "hæmatokrit" has been invented by Herr von Hedin. It is for determining the volume of corpuscles present in blood, and is based on centrifugal action. As described in *Nature*, a volume of blood and one of Möller's liquid (which prevents coagulation) are mixed together, and the mixture is poured into small, thick walled glass tubes, graduated in fifty parts. The tubes rest on a brass holder which is fixed on the axis of a rotation-apparatus. After some eight thousand rotations, in five to seven minutes, the process is complete. The separation between the corpuscles and the salt-plasma is more distinct, in that a narrow band of leucocytes appears between them. The instrument is useful in comparing the blood of different individuals. With a little practice, the total error is not more than one volume per cent.

— Archæologists have, of course, been profoundly interested by the recent discovery of a vault filled with mummies and funereal coffers at Deir Elbahiri, near the plain of Thebes. The Cairo correspondent of the London *Times*, telegraphing on Feb. 24, gives the following as the latest details, according to *Nature* of Feb. 26: "The site of the discovery is east of the Temple of Queen Fatasou, in a small spot previously undisturbed, amidst the excavations made by the late Mariette Bey and Brugsch Pacha. A well-shaft of 15 metres leads to a doorway blocked with large stones, opening on a gallery 73 metres long, whence a staircase descending 5½ metres conducts one to a lower gallery 12 metres in length, both lying north and south. The lower gallery gives access to two mortuary chambers 4 and 2 metres square respectively. At the top of the staircase is a transverse gallery 54 metres long, lying east and west, the object of which is unknown. The total underground area is about 153 metres, excavated in the limestone rock to over 65 feet below the surface. The same disorder reigned amongst the contents of the tombs as was found when the famous royal mummies were discovered nine years ago. Sarcophagi were piled upon sarcophagi, and alongside were boxes, baskets of flowers, statuettes, funereal offerings, and boxes crammed with papyri. There is every indication that the place, though originally constructed as a vast tomb, was chosen for hurried conceal-

ment in time of tumult. Some of the exteriors of the mummy-cases are unusually richly decorated with religious subjects, carefully depicted; others of large size enclose mummies in a broken condition, and were apparently procured hastily, as the spaces for the occupants' names are left unwritten upon. The contents of the papyri are as yet unknown, but hopes are entertained that the writings are of permanent historical interest, and have been thus hidden to avoid destruction. The mummies are priests and priestesses of Ammon, Anubis, Seti, Mentou, and Queen Aahotep, numbering 163, the latest belonging to the twenty-first dynasty. Seventy-five papyri were found in boxes in the form of statuettes of Osiris. Each mummy is also expected to contain more or less valuable manuscripts. The collection is *en route* in barges by the Nile, and will probably reach Cairo in a few days."

— Mr. G. J. Symons, F.R.S., in a letter to the London *Times*, refers to the remarkable dryness in Great Britain during the month of February as follows: "My observations here have been absolutely continuous for more than thirty years, and hitherto the dryest February was that of 1863, when .31 of an inch fell. In 1891 we have less than one-thirtieth of that: we have only .01 of an inch. And if we examine all the other months of the whole thirty-three years, we find that the dryest was May, 1885, with .26 of an inch. These two facts sufficiently indicate the exceptional character of the past month at this station. We had one slight sprinkle in the forenoon of Feb. 7, immediately after one of those intense darknesses (arising from high fog) which are becoming so sadly more frequent in this wilderness of chimneys. It had been dark, — actually darker than on a clear moonless night. Fine mist began to fall. I put some sheets of note-paper in the garden for the rain to fall upon. The shower, if such it could be called, was over in an hour, and every drop had left its inky mark upon the paper. I enclose a portion, that you may have one more proof of the need for drastic measures if London is to be clean enough to live in." Mr. Symons has received only one return from England exceeding .10 of an inch, and this was from the hills above Ullswater.

— Professor Seubert contributes an important paper to *Liebig's Annalen*, in which are presented the final results of his redetermination of the atomic weight of osmium. A preliminary account of the earlier portion of this work was published in the *Berichte* in June, 1888, and a short notice concerning it was given in the columns of *Nature* (vol. xxxviii. p. 183). It was then shown that the atomic weight of osmium was certainly not higher than 191, and was probably a few decimals less. Owing, however, to lack of material, Professor Seubert was not able to complete the work in the unimpeachable manner characteristic of his other atomic-weight determinations. Since that time, however, thanks to the kindness of Professor Lothar Meyer, a sufficient quantity of pure osmium has been placed at his disposal, and the work has been completed in a manner which leaves nothing to be desired. The salts analyzed (*Nature*, March 5, 1891) were potassium and ammonium osmium chloride, K_2OsCl_6 and $(NH_4)_2OsCl_6$. The final mean value derived from all the experiments is 190.3, a number which fully justifies the expectations of Professor Seubert that it would fall slightly below 191. The importance of the settlement of this question cannot be overrated, for it removes the last outstanding exception to the periodic generalization. The metals of the platinum group, — osmium, iridium, platinum, and gold, — when arranged in the order of their chemical and physical properties, unmistakably take the relative precedence just quoted. If these properties are, as every one now agrees, periodic functions of atomic weight, the atomic weights of these metals should increase from that of osmium upwards to that of gold. Previous to the year 1878, however, the accepted atomic weights were: gold, 196.2; iridium, 196.7; platinum, 196.7; and osmium, 198.6, — a relation which, if correct, was diametrically opposed to the principle of periodicity. In that year Seubert attacked the subject, and the first outcome of his labors was to correct the atomic weight of iridium, which he found to be 192 5, instead of 196.7. It was a most remarkable tribute to the accuracy of Seubert's work, and likewise of his own, that Joly a short time ago obtained for the same constant the identical number 192.5. In 1881, Seubert took up the case of platinum, and finally adjusted its atomic weight to 194.3, — a number which was confirmed by a subsequent determination of Halberstadt. In 1887 the position of gold was finally decided by the remarkably agreeing and almost simultaneous determinations of Thorpe and Laurie on the one hand, and Krüss on the other, the value arrived at in both cases being practically 196.7. Finally we have the just completed work of Seubert upon osmium; and the four metals, when arranged in order of atomic weight, now take the order, osmium, 190.3; iridium, 192.5; platinum, 194.3; gold, 196.7, — an order of precedence in full accord with the order of their chemical and physical properties.

— The district in northern Persia where olives flourish, as we learn from the *Journal of the Society of Arts*, London, naturally consists of forty-three villages, which are situated on the confines of the province of Gilân, between Rustemabâd on the north, Manfeel on the south, Tarum on the west, and Rahmetabâd on the east. The British secretary of legation at Teheran says that this group of villages possesses from 80,000 to 100,000 trees, which yield on an average from six to nine pounds of olives per tree per annum, thus giving an annual produce of 560,000 pounds of olives, if the former average be taken. The quantity of good olive-oil derived from the Persian presses may be estimated at 17 per cent of the olives, which would give 127,000 pounds of good oil. The good oil having been extracted, the residue is again pressed, and an oil of inferior quality is produced, which is used in the manufacture of soap. The value of the oil after a good harvest is two *krans* (about 1s. 2d.) per bottle of two pounds weight, at Resht or Teheran, whereas the maximum price paid per bottle after a bad harvest is five *krans*. In obtaining the oil the following process is employed. The olives are gathered late in the autumn, and at once stored in a kind of large bin, where they are left to ferment till the first spring suns; that is to say, till about the festival of the Persian new year, March 21. The olives are then spread out to dry on the flat house-tops. When perfectly dried, they are again packed till they ferment. After this second fermentation, they are trodden by men, somewhat after the fashion in which grapes are trodden in the wine-press. After having been thus trodden, they are boiled, and after boiling crushed in a sort of press between flat stones, a receptacle for the oil being placed beneath the stones. A monopoly for the working and purchase of all the olives in northern Persia was granted to a firm of Russian merchants in a concession given to them by the Shah in 1890; and, in order that no time may be lost in turning a profitable speculation to good account, a member of this firm has, it is said, been already carefully studying the various methods employed in Europe in the pressing and refining of the oil, the method in practice in the olive-oil presses of Marseilles having finally been selected by him. Every olive tree in Persia is subject to a government tax of four *shahis*, or about 1½d. English money.

— Mr. Werner Langguth, writing to *The Engineering and Mining Journal*, states that it may be of interest to some to learn of a comparatively cheap and practical method which will furnish an ample supply of pure oxygen-gas from a solution of chloride of lime (bleaching-powder). The production of this gas and its method were observed and investigated by Mr. Langguth some years ago, and it has since been practically used by him in the laboratory for various purposes. If this method becomes generally known, it may find manifold application owing to its cheapness and simplicity. If a few drops of a solution of a cobalt salt (nitrate of cobalt, $Co(NO_3)_2$, for instance) be added to a strong solution of bleaching-powder in water, $H_2O + CaCl_2 + Ca(ClO)_2$, and shaken well, an evolution of gas will be immediately observed, the production of which will be increased by a slight rise of temperature. The gas thus produced is pure oxygen, free from chlorine, and may be dried, if required, in the usual manner. The evolution is not violent, and the re-action gives an even and continuous flow of oxygen-gas for a long time; that is, until all the bleaching-powder in solution is converted into calcium chloride:

$$CaCl_2 + Ca(ClO)_2 + H_2O = 2O + 2CaCl_2 + H_2O.$$

The few drops of nitrate of cobalt added are precipitated by the bleaching-powder to cobalt hydroxide, which suffers no further

change, only producing by its presence the liberation of the oxygen. It is a beautiful illustration of its catalytic action. It is needless to say that the precipitated oxides can be used over again, *ad infinitum*, with the same effect. The calcium-chloride solution is decanted from the settled cobalt hydroxide in the generator, charged with a fresh solution of bleaching-powder, shaken, and the evolution of oxygen commences again. Nickel salts will act on bleaching-powder in the same manner, but the evolution of oxygen is much slower.

— The twelfth annual exhibition of instruments by the Royal Meteorological Society, London, was opened on Tuesday evening, March 3. The exhibition this year was devoted to rain and evaporation gauges, and such new instruments as have been constructed since the last exhibition. Almost every known pattern of rain-gauge that has been used in this country was shown, and it was interesting to compare the old patterns with the new patterns. Most of the gauges had funnels five or eight inches in diameter. The Meteorological Office 8-inch gauge is generally regarded as the best gauge for ordinary observers, to whom cost is not a primary object, as it has all the good features of the Glaisher and of the Snowdon patterns, and, being of copper, is very durable. In mountainous districts, where the rainfall is heavy, and the gauges can only be periodically examined, gauges capable of holding forty or fifty inches of rain must be used. Specimens of these gauges, as well as of the rain and snow gauges used in France, Germany, Russia, Switzerland, and the United States, were shown in the exhibition. Some interesting storm-gauges and self-recording gauges were also exhibited. The evaporation-gauges included several instruments employed for measuring the evaporation from a free surface of water, and others for use with growing plants. A number of new instruments were also exhibited, among which were various anemometers, recording barometers, and cameras for meteorological photography. An interesting collection of maps of rainfall over the British Isles and various parts of the world, as well as numerous photographs of floods, meteorological phenomena, etc., were also on view. The exhibition remained open till Thursday, March 19.

— Bulletin No. 26 (January, 1891) of the Agricultural Experiment Station of the University of Wisconsin, Madison, is on "Sugar-Beet Culture in Wisconsin." This bulletin presents the results of investigations made during the season of 1890 with sugar-beets for the production of sugar. The work has been under the general direction of the Department of Agriculture, Washington, D.C., which also rendered financial aid. In addition to the experiments carried on at the station, experiments were conducted at five sub-stations,— one in each of the following counties; viz., Walworth, Rock, Waukesha, Marquette, St. Croix, — and by seventy farmers in different parts of the State. A summary of the results is as follows: 1. The six varieties of sugar-beets grown contained from 14.81 to 16.76 per cent of sugar in the juice. The co-efficient of purity ranged from 82.2 to 86.3 per cent. About half an acre of each variety was grown, and the yield of washed beets varied with the different varieties from 16 to 26 tons per acre. The estimated yield of sugar varied from 2 to 3¼ tons per acre. In a well-managed factory about 80 per cent of this quantity would be recovered as pure granulated sugar. 2. A careful account of the work done in planting and cultivating the plats of sugar-beets grown, showed that it cost from 84 cents to $1.38 to grow a ton of beets. This does not include the cost of harvesting and delivery, which may be considered as about equal to that of growing the crop. 3. The beet-culture at five sub stations gave beets whose sugar contents ranged from 12.81 to 17.14 per cent of sugar in the juice, while the beets would have yielded from 4 tons (at the St. Croix County station, where wet cold weather in June caused the beets to rot, and greatly reduced the yield) to nearly 39 tons per acre. The latter heavy yield was estimated from the plats grown at the Waukesha County station. 4. Seventy farmers in 29 counties of the State sent samples of sugar-beets grown by them for analysis. The results of the analyses showed a very wide range, according to the kind of seed used, the manner of growing, skill of the grower, etc. The lowest of all analyses showed 6.48 per cent, and the highest 18.79 per cent, of sugar in the juice. The latter result was obtained from beets grown near New Holstein, Calumet County, from which locality also other samples were obtained containing a very high percentage of sugar, indicating that this section may prove particularly well adapted to sugar-beet culture. Of other sections that seem well suited to this crop may be mentioned the counties of Kewaunee, Washington, Rock, Jefferson, Waukesha, Milwaukee; in short, the whole eastern and south-eastern portion of Wisconsin. Upon further trial, it is hoped that the western portion of the State may also be found adapted to this plant. There seems no cause in soil or climate to prevent good beets being produced there. 5. Beet associations should be formed, and each member should pledge himself to grow from two to three acres of beets, in order to test the capacity and adaptability of the soil in different localities. Common sugar-beet seed may be used for most of the planting, parts of a few rows being from genuine imported sugar-beet seed. 6. The results of the sugar-beet investigations for the year past are very satisfactory, and encourage the belief that Wisconsin is well adapted to sugar beet culture. The people are urged to continue their interest in the matter, to move forward with caution, and in no case to enter upon the construction of beet-sugar factories until there is positive assurance that the farmers will grow sufficient beets to keep the factory running for the whole working season, and that the soil of the particular locality is adapted to the crop.

— United States Consul Bradley of Nice reports that much of the olive-oil exported from France is adulterated with different seed and nut oils. At least seven or eight of the seed products are so employed. When our fellow-citizens imagine that they are eating their salads with olive-oil, it is possible that at least a portion of the oil eaten is either cotton-seed, ground-nut (*Arachis hypogæa*) sesamum, poppy, camelina, rape, or flaxseed oil. The French farmer and the agricultural stations are doing what they can to remedy this, as growers of the olive are being seriously injured by these cheap mixtures, just as our dairy farmers were hurt by manufactured imitations of butter; but they can do little without the assistance of the buyers. It is quite possible to obtain the pure article now by co operating with agricultural stations at shipping points, say, Nice, Marseilles, and Bordeaux. At Nice, M. R. Brullé, director of the agricultural station, says, that, if buyers will make it a condition of their orders that samples of the oil to be shipped be placed at the disposal of the consul or director of the station by the oil-merchant for analysis, he will analyze it and pronounce upon its purity, giving a certificate of the same to the merchant shipper. On receipt of the consignment, the buyer, if he wishes, can repeat the examination by a comparatively simple process recently discovered by M. Brullé. If oil has not been sent according to sample furnished, the shipper will be liable to a criminal action. The fear of this would be a strong reason for honesty.

— At a recent meeting of the Ohio State Horticultural Society, and also of the Columbus (Ohio) Horticultural Society, resolutions were passed asking the State Legislature to pass a law compelling owners of plum and cherry trees affected by black knot to destroy the infested branches. In a bulletin just issued by the New Jersey Experiment Station, Professor B. D. Halsted, one of our most eminent economic botanists, urges the passage of such a law in that State, giving the following reasons therefor: "There are some good reasons for legislating against the black knot (*Plowrightia morbosa*) of the plum and cherry trees In the first place, the fungus is beyond question extremely destructive: whole orchards of large size in many parts of the country have been abandoned because of this parasitic plague. Second, it is a conspicuous disease, and during a half of the year when the trees are defoliated the knots can be found without the least difficulty. Any attempts to shield the trouble, on the part of the owner, would be fruitless, even if he should care to preserve the curse. In the third place, the remedy is the very heroic one of the knife, and easily, safely, and with certainty applied. There may be some compounds put upon the diseased parts that will kill the fungus; but it is so deeply seated, that, when a twig is thoroughly infested, there is little left for the fruit-grower to do but to cut

away and burn the black excrescences. If a tree is badly attacked, the wise method is to cut down bodily, and destroy it by fire. Finally, when once the old knots are cleared out, it will be an easy matter to keep the fungus from gaining a fresh foothold. There are many trees which are literally covered with knots, and have been for years, — trees which bear no fruit, and never will, — and they are worse than mere monuments of carelessness, for they propagate and perpetuate a disease that renders plum-raising almost an impossibility in their neighborhood. Sometimes these old, distorted trees are on the roadside, where any passing lad can pull off and carry to his own home one of these malformations, to become a new centre of infection. But these knots do not need to be transported to produce infection, for the millions of spores developed in the spring, while too small to be seen, pass long distances with the winds, and thus spread the disease. There are several fungous diseases against which the State Legislatures or the National Congress might pass enactments fully as wholesome and beneficial as those for the control of the diseases of animals; but few of them offer so many favorable points for successful legislation as the black knot, — the scourge of plum and cherry growers in many localities. The law should include, to be effective, all wild plum and cherry trees that are breeding-places of the pest."

— Mr. E. H. Hankin of St. John's College, Cambridge, Eng., is said to have discovered a cure for anthrax, to the study of which disease he has devoted himself many years. He based his investigations, according to *Hardwicke's Science-Gossip*, upon the principle of lymph inoculation, which Dr. Koch has so successfully applied in the case of tuberculosis. The glycerine extract in Mr. Hankin's process is precipitated with alcohol, and re-dissolved in water. The experiment has been repeated on a number of subjects with gratifying success. This discovery derives additional interest from the fact that anthrax is not the only disease from which rats (the spleen of which animal produces the protective proteid) enjoy immunity.

— An insect which is not uncommon in India is a medium-sized mantis, between three and four inches in total length. It is one of those mantises, says Mr. J. R. Holt in *Science-Gossip* for March, which have a long slender thorax, and which, owing to the second and third pairs of legs being very long, carry their thorax and head very high. In this insect the thorax is about half its entire length, and is of a bright grass-green color, without any markings, and it obviously mimics a grass-stem. The abdomen is also somewhat slender; the wing-covers are of a grass green color, without markings; and it obviously mimics a grass-blade. But in both these cases the mimicry is obvious, as also the reason for it, and it is not what Mr. Holt would call attention to. The first joint of the fore-legs is widened and flattened; it is also green, and the posterior surface is marked with a large ocellus. When the insect is undisturbed, it remains generally in one place, but is not perfectly motionless: it sways perpetually and uniformly from side to side. In this position it looks very harmless, but if it is startled or alarmed its aspect instantly changes: it partly opens the wings, turns its head and thorax so as to face the terrifying object, makes a noise like a sudden, sharp puff of wind, very like the noise made by a startled snake, and raises its fore-legs so that the first joint lies along the thorax; and, the inside margin of the expansion being nearly straight, it looks as if the fore-legs and thorax were connected. In this position the ocelli are very conspicuous, and, with the small, triangular head and the slender thorax, the effect is to produce a ludicrous resemblance to a diminutive cobra. Now, what puzzles one, is this exact resemblance. The insect could not possibly be taken for a cobra on account of its small size and green color; while, if the object is only to appear formidable, it could have been obtained without imitating a cobra so exactly. It may be suggested that there is no direct imitation, but that the same causes which have led to the development of the eye spots in the cobra have also led to the development of ocelli in this insect, viz., that the apparent possession of a large head gives the animal a more formidable appearance; but this explanation is apparently negatived by the peculiar noise made by the insect, which certainly seems to indicate that a snake is imitated. Possibly the object of the noise is to suggest that it is some kind of snake, and then the ocelli may suggest that it is one of the cobra kind. Maybe some of our readers may be able to suggest a better explanation. Anyhow, the thing is curious, and worthy of note.

— There is now direct telephone communication between London and Paris. The first conversation between the two cities was exchanged on March 17, and, according to press despatches, the results were highly satisfactory.

— The Illinois Experiment Station is located on a black loam about twenty inches deep, underlaid with clay,— the soil common to the prairies of Illinois. Thus located, that station is wisely devoting much of its resources to the study of the great cereal crop, corn. In Bulletin No. 13, for February, 1891, is given a detailed report of the experiments of corn made at that station for 1890, with a summary of the results for 1888 and 1889. The results may be summarized as follows: Of the varieties of corn treated, the medium maturing sorts (such as Leaming, and white varieties of similar season) are recommended for central Illinois. These have given a higher yield, without exception, than those maturing earlier or later. Good crops of corn were raised from a medium maturing variety when planted any time in May. Planting at about one inch in depth has been followed by larger crops on the average than deeper planting. Corn planted at the rate of one kernel every twelve inches, in rows three feet eight inches apart, gave a larger average yield of grain than when planted either thicker or thinner. Better results were obtained from planting in hills than in drills, apparently because in hill-culture the corn could be kept cleaner. No appreciable benefit has been derived from frequent cultivation, nor from cultivation after the ordinary time. For the three years the yield has been increased to the extent of one-fourth by shallow cultivation. The plat which had no cultivation after planting, except to remove the weeds by scraping with a sharp hoe, yielded more each season than the average of the deep cultivated plats, and in but two instances did any one of the deep cultivated plats yield more than the plat not cultivated. These experiments indicate that any cultivation of the soil which effectually removes the weeds, and at the same time disturbs the roots as little as possible, is the best; and that on this soil the stirring of the ground beyond what is necessary to kill the weeds is of little if any benefit. No practical benefit was received from the use of commercial fertilizers. The increased yields from the use of stable manure probably repaid the cost of the application, and left some profit.

— In a recent bulletin of the Geological Society of America, Robert Bell, M.D., assistant director of the Geological Survey of Canada, describes the nickel and copper deposits of Sudbury district, Canada. There is also an appendix on the silicified glass-breccia of Vermilion River, Sudbury district, by George H. Williams. The town of Sudbury, a creation of the Canadian Pacific Railway, is situated in the backwoods of Ontario, thirty-six miles north of the mouth of French River, on Lake Huron. Other metals, including gold, platinum, tin, lead, silver, zinc, and iron, have been found in the Sudbury district, and probably some of them may prove to exist there in paying quantities. The presence of a considerable proportion of nickel in the ore of the Wallace mine, on the shore of Lake Huron, and in the strike of the Sudbury deposits, was ascertained by Dr. Hunt more than forty years ago; yet the presence of this metal in the latter does not seem to have been suspected for a considerable time after they had been worked for copper alone. The Huronian is notably a copper-bearing system. West of Sudbury, this metal occurs around Batchawana Bay, north of Sault Ste. Marie, at Little Lake George and Echo Lake, at Huron Copper Bay, in Wellington and Bruce mines, on Thessalon and Mississagui Rivers, and elsewhere. To the northeastward it has been found on both sides of Lake Wahnapitæ, on Temagami and Lady Evelyn Lakes, along Montreal and Blanche Rivers, on the watershed east of the canoe route between Lakes Temiscaming and Abbittibi, and finally near the southern extremity of Lake Mistassini. The search for this metal along the Huronian belt is only in its infancy, and the copper-mining industry may some day be very extensively carried on in various parts of this as yet almost unknown section of Canada.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

MARRIAGE.[1]

IT always gives me pleasure to respond to the invitation of the members of the Literary Society of Kendall Green, and it will always be my object in addressing you to choose subjects that will be of interest and importance to you in your future lives. You have come together here from every part of the United States to receive in the National College for Deaf-Mutes that higher education which you cannot obtain in the States from which you came.

In a very little while — it may be in one year, or two years, or more — you will separate from one another, and each go back singly to the places from which you came, to begin the battle of life. You will go out into the great world,— the world of hearing and speaking people, a world of people who cannot spell upon their fingers or make signs. Are you prepared for that change, and what is to be your position in that world?

I would have you all remember that you yourselves are a part of that great world of hearing and speaking people. You are not a race distinct and apart, and you must fulfil the duties of life, and make your way to honorable positions among hearing and speaking people.

Now, I have considered what subject I could bring to your attention to-night the consideration of which would be of assistance to you when you go out into the world; and there is no subject, I am sure, that lies closer to your hearts than the subject of marriage.

It is a very difficult thing for me to speak to you upon that subject, because I know that an idea has gone forth, and is very generally believed in by the deaf of this country, that I want to prevent you from marrying as you choose, and that I have tried to pass a law to interfere with your marriages. But, my friends, it is not true I have never done such a thing, nor do I intend to; and before I speak upon this subject I want you distinctly to understand that I have no intention of interfering with your liberty of marriage. You can marry whom you choose, and I hope you will be happy. It is not for me to blame you for marrying to suit yourselves; for you all know that I myself, the son of a deaf mother, have married a deaf wife.

I think, however, that it is the duty of every good man and every good woman to remember that children follow marriage, and I am sure that there is no one among the deaf who desires to have his affliction handed down to his children. You all know that I have devoted considerable study and thought to the subject of the inheritance of deafness, and if you will put away prejudice out of your minds, and take up my researches relating to the deaf, you will find something that may be of value to you all.

We all know that some of the deaf have deaf children,— not all, not even the majority, but some,— a comparatively small number. In the vast majority of cases there are no deaf offspring, but in the remaining cases the proportion of offspring born deaf is very large,— so large as to cause alarm to thoughtful minds. Will it not be of interest and importance to you to find out why these few have deaf offspring? It may not be of much importance to you to inquire whether by and by, in a hundred years or so, we may have a deaf variety of the human race. That is a matter of great interest to scientific men, but not of special value to you. What you want to know, and what you are interested in, is this: are you yourself liable to have deaf offspring? Now, one value in my researches that you will find is this: that you can gain information that may assure you that you may increase your liability to have deaf offspring or diminish it, according to the way in which you marry.

The Rev. W. W. Turner of Hartford was the first, I think, who showed that those who are born deaf have a greater liability to have deaf offspring than those who are not. He showed, that, where a person born deaf marries another person born deaf, in this case about one-third of the children are deaf. Mr. Job Williams, the present principal of the Hartford Institution, has still more recently examined the subject; and, in a letter published in *Science* a short time ago, he arrives at the same conclusion,— about one-third are born deaf. In 1888, Mr. Connor, the principal of the Georgia Institution, made an examination of the results of the marriages of his pupils, and his statistics are published in "Facts and Opinions relating to the Deaf." He also comes to the same conclusion,— about one-third are born deaf.

The following table will show you the exact figures:—

TABLE I.— *Concerning the Offspring of Couples Both of Whom were born Deaf.*

Authority.[1]	Total Number of Families.	Total Number of Children.	Number of Deaf Children.	Percentage of Children who are Deaf.	Number of Deaf Children to every 100 Families.
Turner (1868)...	24	57	17	29.8	70.8
Connor (1888)...	16	59	19	32.4	118.7
Williams (1891)...	52	151	48	31.8	92.3

It is obvious that persons born deaf run considerable risk of having deaf offspring if they marry persons who are also born deaf.

If we take all the marriages of congenitally deaf persons, without reference to whether they married deaf or hearing persons, we have five independent sets of statistics from which we may derive information regarding the effects upon the offspring. (1) My own researches indicate that where

[1] An address delivered to the members of the Literary Society of Kendall Green, Washington, D.C., March 6, 1891, by Alexander Graham Bell.

[1] For Rev. W. W. Turner's results, see my Memoir, p. 20. For Mr. Connor's results, see Facts and Opinions relating to the Deaf, p. 61. For Mr. Job Williams's figures, see Science, vol. xvii. p. 76, published Feb. 6, 1891. Dr. Gillett, in Science (vol. xvii. p. 59, Jan. 30, 1891), says there were thirteen couples in the Illinois Institution in which both parties were born deaf. One of these couples had two hearing children and one deaf child. He does not state how many children were born to the other twelve couples, but says they could all hear.

one or both of the parties were born deaf there will be fifteen deaf children in every hundred families; (2) Dr. Gillett's statistics give eighteen deaf children to every hundred families; (3) Dr. Turner's, thirty-two; (4) Mr. Williams's, forty-seven; and (5) Mr. Connor's, ninety-five.

TABLE II. — *Concerning the Offspring of Couples One or Both of Whom were born Deaf.*

Authority.[1]	Total Number of Families.	Total Number of Deaf Children.	Percentage. (Number of Deaf Children to every 100 Families.)
Turner (1868)	190	61	32.1
Bell (1883)	360	56	15.5
Connor (1888)	22	21	95.4
Gillett (1891)	71	13	18.3
Williams (1891)	211	101	47.8

Persons who are reported deaf from birth, as a class, exhibit a tendency to transmit the defect; and yet when we come to individual cases we cannot decide with absolute certainty that any one was born deaf. Some who are reported deaf from birth probably lost hearing in infancy; others reported deaf in infancy were probably born deaf. For educational purposes the distinction may be immaterial, but in the study of inheritance it makes all the difference in the world whether the deafness occurred before or after birth. Now, in my researches I think I have found a surer and more safe guide to those cases that are liable to transmit the defect.

The new guide that I would give you is this: look at the family rather than at the individual. You will find in certain families that one child is deaf and all the rest hearing, the ancestors and other relatives also being free from deafness. This is what is known as a "sporadic" case of deafness, — deafness which afflicts one only in a family.

Well, the deafness in such cases may be accidental. There is no proof that such deafness is liable to be inherited, excepting where the person is reported deaf from birth. In the vast majority of cases reported deaf from birth there is an undoubted tendency to inheritance; but where the deafness is caused by meningitis, scarlet-fever, or like causes, and no other case of deafness exists in the family, there is probably little, if any, tendency to inheritance. But when you have two members of one family deaf, or three, or four, or five, there you have the proof that a tendency to deafness exists in the family. What I term "family deafness" exists there. Something has been transmitted from the parents to the children that has caused deafness, or helped to cause it. I remember a case in which there were four children in one family deaf, and none of them were born deaf. One child became deaf, perhaps, from measles, another from scarlet-fever, etc. I do not now remember exactly what causes were stated. They became deaf, however, at different times, and from apparently accidental causes. But can we consider that it was accidental that there should have been four children in one family deaf? The fact that a number of children in the same family are deaf points to an inherited tendency to deafness in the family. One result of my researches is to show the great importance of studying the results of marriages of persons who come from families of that kind. My results, however, until verified by other observers, should be received as probable only, and not certainly proved.

[1] References as for Table I. For my own results, see Memoir, p. 25.

So far as I can find out, the hereditary character of the defect in a family is roughly indicated by the proportion of the family who are deaf. If you make a fraction, and place the number of deaf children above as the numerator, and the total number of children below as the denominator, for example, $\frac{1}{6}$, that fraction will give you some idea of the tendency to deafness in that family: one child in six is deaf. Again, take a case in which three out of six are deaf ($\frac{3}{6}$). Now, the tendency to transmit deafness in this family ($\frac{3}{6}$) will be greater than in that ($\frac{1}{6}$). Every member of the first family ($\frac{3}{6}$), whether deaf or hearing, will have a greater tendency to have deaf children than the members of the other ($\frac{1}{6}$). In general, the tendency to transmit deafness is greatest in those families that have the largest proportion of deaf members, and smallest in those that have the least. This conclusion is exceedingly probable, and should therefore be taken as a guide by those who desire to avoid the production of deaf offspring. If you marry a hearing person who has three or four deaf brothers and sisters, the probability of your having deaf children will be greater than if you marry a deaf person (not born deaf) who has no deaf relatives.

The statistics collated by me ("Memoir," p. 25) indicate that 816 marriages of deaf-mutes produce 82 deaf children: in other words, every 100 marriages are productive of 10 deaf children. That is a result independent of the cause of deafness, — an average of all cases considered. Eliminating 40 cases where the cause of deafness is not given, I divide the remaining 776 cases into 4 classes: —

Class 1. Persons not born deaf who have no deaf relatives.

Class 2. Persons not born deaf who have deaf relatives.

Class 3. Persons born deaf who have no deaf relatives.

Class 4. Persons born deaf who have deaf relatives.

TABLE III.

	Number of Families.	Number of Deaf Children.	Percentage. (Number of Deaf Children to every 100 Families.)
Class 1. Not born deaf, no deaf relatives	363	17	4.7
Class 2. Not born deaf, deaf relatives	53	5	9.4
Class 3. Born deaf, no deaf relatives	130	15	11.5
Class 4. Born deaf, deaf relatives	230	41	17.8

The percentage results are shown by themselves in the following table (Table IV.), in which the figures indicate the number of deaf children produced by every 100 marriages of persons belonging to Classes 1, 2, 3, and 4.

TABLE IV.

PERIOD OF LIFE WHEN DEAFNESS OCCURRED.	CHARACTER OF THE DEAFNESS.	
	Sporadic Deafness.	Family Deafness.
After birth	4.7	9.4
Birth	11.5	17.8

My statistics are confessedly very imperfect, and many persons have hastily concluded that the results are therefore

of no value or significance. This, however, is not the case; for the imperfection of the statistics assures us that the figures given are all underestimates, the true number of deaf children in every case being greater than that mentioned. As a matter of fact, all the statistics since collected by others have shown larger percentages.

While it is believed that the true percentages are larger than those given, it is probable that they are proportionately larger; so that we may conclude with probable accuracy that persons belonging to Class 4 are more liable to have deaf children than those belonging to Class 3, those of Class 3 more liable than those of Class 2, and those belonging to Class 1 are the least liable of any, to have deaf offspring. The relative liabilities are probably represented by the percentage figures.

The results are imperfect from another cause. The institution reports from which the statistics were compiled did not give details concerning both the parties to a marriage.

It would be stated that Mr. So-and-so "married a deaf-mute;" but no information would be given as to whether his wife was born deaf or not, or whether she had or had not deaf relatives. I have only been able, therefore, to classify the marriages by one side. For example: the results noted for Class 1 give the summation of all marriages of persons not born deaf who have no deaf relatives, quite regardless of the fact that some of them married congenital deaf-mutes, others semi-mutes, and still others hearing persons. We may deduce, however, from the figures, that, if the husband belongs to Class 1, his liability to have deaf offspring will be greatest if his wife belongs to Class 4, and least if she belongs to Class 1, etc.

Now that Professor Fay has taken up the subject, I hope that we may obtain statistics of greater accuracy and importance than any yet compiled.

When we obtain statistics classified by both parties to the marriage, I think it will be found, that, where persons belonging to Class 1 marry persons also belonging to Class 1, there will be no deaf offspring, or, at least, that the percentage of deaf offspring will be insignificant; for surely accidental deafness is no more liable to be inherited than the accidental loss of an arm in battle, for instance. If, however, a person born without an arm should marry a person also born without an arm, some of the children would probably exhibit the same defect. In a similar manner, persons belonging to Classes 2, 3, and 4 exhibit a decided tendency to transmit deafness to their offspring.

Now, there is a law of heredity that may afford great comfort to many of the deaf, — the law of reversion. There is a very strong tendency in offspring to revert to the normal type of the race. It requires constant selection from generation to generation on both sides to perpetuate any abnormal peculiarity. There will always, therefore, be a tendency to produce hearing children rather than deaf, excepting in cases where both parties to a marriage come from families belonging to Classes 2, 3, and 4.

Probabilities for Your Guidance.

Whatever may be the character of the deafness in your own case, you will probably diminish your liability to have deaf offspring (1) by marrying a hearing person in whose family there is no deafness; (2) by marrying a deaf person (not born deaf) who has no deaf relatives (Class 1), or a hearing brother or sister of such a person.

On the other hand, you will probably increase your liability to have deaf offspring (1) by marrying a deaf person (not born deaf) who has deaf relatives (Class 2), or a hearing brother or sister of such a person; (2) by marrying a deaf person (born deaf) who has no deaf relatives (Class 3), or a hearing brother or sister of such a person; (3) by marrying a deaf person (born deaf) who has deaf relatives (Class 4), or a hearing brother or sister of such a person.

Of course, if you yourself were born deaf, or have deaf relatives, it is perfectly possible that in any event some of your children may be deaf. Still, I am inclined to think, that, if you marry a member of a family in which there is no deafness (or only a single case of non-congenital deafness), you will not only have fewer deaf children than if you married into a family containing a congenital deaf-mute, or a number of deaf persons, but the deafness of your children will not tend so strongly to be handed down to the grandchildren. The tendency to inheritance will be weakened in the one case, and intensified in the other: that is, in the former case your deaf child will have a less tendency to transmit his defect to his children than you yourself possess; in the latter case, a greater tendency.

Take the case of a family in which three or four children are born deaf.

Now, suppose that all the members of this family and their deaf descendants are careful to marry only into families which are free from deafness, or which contain only single cases of non-congenital deafness. Then the probabilities are that at each generation the percentage of children born deaf will be less, and the proportion of hearing children greater, until finally the deaf tendency disappears, and all the descendants will hear.

On the other hand, suppose that the members of this family and their deaf descendants marry into families containing a congenital deaf-mute, or containing several deaf persons. Then the probabilities are that at each generation the percentage of children born deaf will increase, and the proportion of hearing children will be less, until finally the tendency to produce hearing offspring disappears, and all the descendants will be deaf. This family would then constitute a deaf variety of the race, in which deaf offspring would be the rule, and hearing offspring the exception.

Now, the point that I would impress upon you all is the significance of family deafness. I would have you remember that all the members of a family in which there are a number of deaf-mutes have a liability to produce deaf offspring, the hearing members of the family as well as the deaf members.

This, I think, is the explanation of the curious fact that the congenitally deaf pupils of the Hartford Institution who married hearing persons had a larger percentage of deaf children than those who married deaf-mutes. It is probable that many of the hearing persons they married had brothers or sisters who were born deaf.

Cases will constantly arise in which a proposed marriage will appear undesirable and desirable both at the same time. For example: a semi-mute having no deaf relatives may form an attachment for a congenitally deaf person in whose family deafness may be hereditary. Of course, I have nothing to say as to what the young people should do: that is a matter for them to decide. I cannot even undertake to advise. The semi-mute will have no tendency to have deaf children if he or she will marry a person of similar kind (Class 1), or marry a hearing person belonging to a family in which there is no deafness: hence this person, by marrying a congenitally deaf person in whose family deafness is hereditary, will create a liability to have deaf offspring which would not

otherwise exist. From this point of view, the marriage is undesirable.

On the other hand, from the point of view of the person born deaf, such a marriage is extremely desirable, for it will diminish the hereditary tendency in his family. In such a case, the friends of one party would probably favor the union, and the friends of the other advise against it; and the mutual friends of both could only say, "It is desirable to one, and undesirable to the other: we cannot advise; your own hearts must decide the matter."

Now, I have come before you to-night to show you that there may be something in my researches of benefit to you; I want also to assure you that there is nothing of harm. I want to disabuse your minds entirely of the idea that I intend or desire to interfere with your perfect liberty of choice. I claim the right to advise you as I would advise my own children, or any young people in whom I feel an interest. In this matter my views coincide very closely with those recently expressed by President Gallaudet through the columns of *Science*. You have to live in a world of hearing and speaking people, and every thing that will help you to mingle with hearing and speaking people will promote your welfare and happiness. A hearing partner will wed you to the hearing world, and be of inestimable value to you in all the relations of life. Not only will your own success in life be thereby increased, but the welfare of your children will be materially promoted. It is surely to the interests of children, both deaf and hearing, that one at least of their parents should hear.

I would therefore hold before you as the ideal marriage a marriage with a hearing person. Do not let any one place in your minds the idea that such a marriage cannot be a happy one. Do not let any one make you believe that you cannot find a hearing person who will treat you as an equal. The chances are infinitely more in your favor that out of the millions of hearing persons in this country you may be able to find one with whom you may he happy than that you should find one among the smaller numbers of the deaf.

I think the sentiment is hurtful that makes you believe you can only be happy with a deaf companion. That is a mistake, and, I believe, a grave one. I would have you believe that the welfare of yourself and your children will be greatly promoted by marriage with a hearing partner, if you can find one with whom you can be happy.

And now, my friends, I must thank you very much for the attentive way in which you have listened to me, and I hope that you will all dispel from your minds any idea that I intend to interfere with your liberty of marriage. I know that very grave misconceptions of my position and views have been circulated during the past few years among the deaf. I have before me to-night an audience composed of the brightest and most intelligent minds among the deaf, and I want you to help me in dispelling these ideas.

These misconceptions have arisen chiefly, I think, from too great reliance upon newspaper stories and second-hand information. The newspapers seem to know a good deal more about my opinions and views than I do myself, and I am constantly seeing items about myself that have utterly no basis in fact. Only a few weeks ago I read in a newspaper a long report of an interview with me that never took place. The substance of that article has since been copied from paper to paper all over the United States. I happened to be suffering from a slight headache when the reporter called at my hotel, and I thought this would afford a good excuse for avoiding an interview. I therefore sent my compliments to the reporter, and begged to be excused. He went away, and I thought that that was the end of the matter. Alas, no! Next morning I found myself in the paper, in large capitals, giving forth opinions relating to the education of the deaf that I had never expressed.

Now, I would impress upon your minds the fact that if you want to do a man justice, you should believe what a man says himself rather than what people say he says. There is no man in America, I think, who has been more interviewed by newspaper reporters than I have, and I can assure you that I have never yet seen a report of an interview with me that was free from error.

But now I begin to be afraid of you; for you are the interviewers in this case, and I wonder how I shall be reported by you in the newspapers of the deaf. I am talking to you by word of mouth, while my friend, Professor Fay, is translating what I say into the sign-language. Then by and by you will translate it all back again into English for the benefit of your deaf friends in distant parts. You are the interviewers this time, and I fear you are just as liable to make errors of statement as the ordinary newspaper reporter. I have therefore brought with me to-night a gentleman who has taken a stenographic account of all that I am saying to you. I will look over his notes and correct them, and then it will afford me pleasure to present every member of the Literary Society with a printed copy of my remarks. Allow me, therefore, to request the correspondents of distant papers kindly to reserve their notes of my remarks until they can get my own words in black and white.

I must thank you very much for the attention with which you have listened to me, and in conclusion I would simply say, that, if any one here desires to ask me questions upon the subject of my address, I shall be happy to do my best to reply.

BRITISH NEW GUINEA.

MR. J. P. THOMSON read a paper in December last, on "The North-east Coast of British New Guinea, and some of the Adjacent Islands," before the Queensland Branch of the Royal Geographical Society of Australasia, an abstract of which appears in *The Scottish Geographical Magazine* for March. He remarked on the absence of information regarding this coast before the establishment of the British authority in New Guinea, which he accounted for by the fact that this part is less accessible from Australian ports than the south-eastern coast. The mountain-ranges, when viewed from a distance, seemed to rise abruptly from the shore, leaving no margin of cultivable land, and the natives bore the reputation of barbarous cannibals. Moreover, the indentations of the coast, such as Goodenough, Collingwood, Dyke Acland, and Holincote Bays, are too exposed to afford safe anchorage for ships in stormy weather. Sir William Macgregor, therefore, could not fail to bring back a large fund of information from his expedition to this coast in July, 1890.

The Anglo-German boundary is defined on the coast by Mitre Rock, a mass of conglomerate rising upon, or near to, the 8th parallel of south latitude, to a height of 60 feet above the water, with an opening about 12 feet high and 1 yard broad extending through it from north to south. Within a quarter of a mile of this rock, Boundary Cape, so named by Sir Peter Scratchley, projects into the sea, a promontory of low forest-clad hills rising to a height of 400 to 500 feet. No natives were discovered until the expedition had advanced as far south as Caution Point, where a large village on the coast is inhabited by a powerful tribe. The men ornament their chins with false beards extending from ear to ear, and decorate their heads with cassowary feathers, shells, and fibres; but tattooing seems not to be in fashion among them. The largest tribe met with inhabits a district of hilly ground and sago swamps lying to the south of Boundary Cape, behind which

undulating country extends up to the ridges of the Owen Stanley Range. They are unacquainted with the use of iron, and, though friendly disposed towards white men, could not be persuaded to exchange their spears, adzes of jade and basalt, etc., for hardware or other articles.

The border of Dyke Acland Bay is occupied by a group of villages to which Sir W. Macgregor gave the name of Oro; but, as it was derived simply from the words used by the local guide on approaching the shore, there is some doubt whether it is a tribal name or not. These villages are situated amidst the forest and grassland sloping down from the Hydrographer's Range, the spurs of which are inhabited by a population of about 3,000. At the eastern extremity of Dyke Acland Bay lies Cape Nelson, remarkable for its numerous indentations, some of which, such as Maclaren Harbor and Port Hennessey, so named by Sir W. Macgregor, are excellent havens of refuge for shipping. Within the perimeter of this cape lie two mountains, — Mount Trafalgar, rising to a height of some 4,000 feet; and, to the south of it, Mount Victory, probably 3,500 feet high. The latter is an active volcano; for in the early morning steam was observed rising from its two crests, and from a ridge at a lower elevation, and, as the day advanced, the whole top of the mountain became obscured by dense exhalations. Whereas Mount Trafalgar is clothed to its summit with forest, the volcano is precipitous, and crowned with masses of bare rock. Another large inlet, Collingwood Bay, lies between Cape Nelson and the next promontory, which terminates in the two headlands, Kibirisi Point and Cape Sebiribiri (or Vogel).

On the western shore dwells the Maisina tribe, in villages of inferior construction. The houses hold only one family each, and their roofs project to about three feet from the ground, thus forming verandas. These natives also are unacquainted with iron and tobacco, and adorn themselves with the usual ornaments of feathers, shells, and dog's teeth. The country towards the interior is low, and densely covered with forests, in which the *casuarina* is conspicuous. Several villages stud the coast between Kibirisi Point and Cape Sebiribiri; and opposite one of them, named Kapikapi, rise two singular masses of coral, probably eighty feet high, on each of which stand about a dozen houses. These, being stocked with spears and approached by wooden ladders, removable when necessary, are probably used as strongholds.

After Cape Sebiribiri, Goodenough Bay is reached, stretching to East Cape on Ansell's Peninsula, — a district that has gained a sad notoriety from the murder of Capt. Ansell and the destruction of the "Star of Peace" in 1888. The head of the bay is interesting from the miniature plateaus, elevated about 300 feet above the sea-level, of which the land is composed, and which have been formed by the soil washed down from the ravines in the background. The climate of this part of New Guinea is probably healthy; but the absence of navigable rivers would prove a great obstacle to the cultivation of suitable lands in the interior, if such should be found.

Sir W. Macgregor also visited the Trobriand, Murua (Woodlark), and Nada (Lauchlan) Islands, situated far away to the north and north-east of East Cape, between the parallels of 8° 25′ and 9° 23′ south latitude, and the meridians of 150° 30′ and 153° 40′ east longitude. Nada is a group of islets, about nine in number, forming an atoll, with a lagoon seven to twelve fathoms deep, and is inhabited by 169 natives. Murua, to the west of Nada, is about thirty-eight miles long, and possesses a good harbor. The natives have entered the iron age, and have abundance of food, consisting of yams, *taro*, and sweet-potatoes. The Trobriand Islands lie to the north-west of Murua. The whole group is of coral formation, and is densely covered with forest, and the fertility of the soil is indicated by the abundance of cultivated food. The natives also catch large quantities of fish. They were very friendly with Sir W. Macgregor's party, and very eager to trade. These islands are so much more important in extent and population than had been reported, that several weeks might be spent in thoroughly exploring them.

WALTER DAMROSCH has set Lord Tennyson's poem to music in last week's *Truth*.

BOOK-REVIEWS.

Primitive Folk-Studies in Comparative Ethnology. By ELIE RECLUS. New York, Scribner & Welford. 8°. $1.25.

FEW writers on science, and none on geography, command a more attractive style than Reclus. His vast reading supplies him with a wonderful wealth of analogy; he is never dull; and his philosophizing, which he is not shy to offer, is fresh and progressive.

In the volume before us he undertakes a study of the sociology of half a dozen "primitive" or savage nations, the avowed object being to furnish from them a picture of the condition of man in general in prehistoric ages. Of these half-dozen nations, two are selected from America,— the Eskimos or Inuits, and the Apaches, — while the other examples are from India, as the Nairs, the Kolarians of Bengal, and the tribes of the Neilgherry Hills.

The ethnography of the American portion leaves considerable to be desired. The author includes in the Eskimos the Chukchis (Tchouktches) of Siberia and the Koloschs of the North-West Coast, neither of whom are in any way related to the Inuit. He further speaks of the Kolosches as distinct from the Tlinkits, though these are merely two names for the same people. In enumerating the Apache tribes (p. 123) he confuses them with the Yumas, who belong to a wholly different stock, and again with the Pah-utes (p. 140), who are distinct from both. These unfortunate errors throw a shade of inaccuracy over his descriptions, because, though correct in themselves, they do not always apply to the peoples whom he sets out to depict.

His authorities are usually carefully selected, and his quotations highly illustrative. A tendency to force into prominence certain sociological theories is perhaps visible. Thus, the doctrine of primitive communal marriage is evidently one he holds in high esteem, and seeks to support by all the evidence possible. Much that he adduces to this effect would bear another interpretation. The observations (pp. 69, 70, and elsewhere) on the strange relations which have ever existed between the sexual passions and the religious sentiments are very suggestive, and deserve further expansion and analysis.

Of these studies, that on the Kolarians of Bengal is perhaps the most vivid, and, though it is the last in the book, the reader may profitably begin with it, in order to learn promptly the style and resources of the author.

AMONG THE PUBLISHERS.

BULLETIN No. 78 of the North Carolina Agricultural Experiment Station is on agricultural grasses best adapted to North Carolina soil and climate.

— A novelty in periodical literature is the *Kings' Jester*, the first number of which has just appeared. It is devoted to the wit, humor, art, and advantages of advertising, and is published by Herbert Booth King & Brother, the well-known advertising agents of this city.

— Messrs. Macmillan & Co. announce as among their publications this summer a "Text-Book of the Developmental History of the Vertebrates," by Dr. Oscar Hertwig, professor of comparative anatomy in the University of Berlin, translated and edited by Dr. E. L. Mark, professor in Harvard University, fully illustrated; also a "Text-Book of the Developmental History of the Invertebrates," by Drs. Korschelt and Heider of Berlin, translated under the supervision of Dr. E. L. Mark of Harvard, fully illustrated.

— Darwin's book on "The Structure and Distribution of Coral Reefs" has been issued as one of the Camelot Series by Walter Scott of London, the New York publishers being A. Lovell & Co. The edition includes an introduction by Joseph W. Williams. As the price is low and the volume attractively made up, the book is worth examining by those interested.

— Part II. of Whiting's "Short Course of Experiments in Physical Measurements" has just been issued, and covers measurements in sound, dynamics, magnetism, and electricity. Mr.

Whiting was for some years connected with the Jefferson Physical Laboratory of Harvard College, and this work embodies the results of his experience in teaching physical measurements to the Harvard students.

— In "Domestic Science," by James E. Talmage, Ph.D., published by the Juvenile Instructor Office, Salt Lake City, Utah, the author has attempted to bring together in a simple manner such topics as have a direct bearing upon the science of domestic operations. His object has been to direct attention to daily household affairs, and we think he has treated his subject with fair success.

— Messrs. Ginn & Co. announce to be published in the summer of 1891, "The Prometheus Bound of Æschylus, with the Fragments of the Prometheus Loosed," with introduction and notes by N. Wecklein, rector of the Maximilian Gymnasium in Munich, translated by F. D. Allen. The book is a translation, with some freedom as to form of expression, of Wecklein's second edition (1878). A few changes in text and commentary have been requested by the German editor, and references to American grammatical works have been added by the translator. The copious explanatory commentary is followed by a critical appendix.

—Messrs. Ginn & Co. have published a small volume entitled "A Primer of Ethics," designed as an instruction-book and monitor for children. It is really a new edition of "The Rollo Code of Morals," published many years ago by Jacob Abbott; but the original work has been revised, with additions and omissions, by Benjamin B. Comegys. It treats of all those phases of morals which it is most important for young people to understand, and for the most part in a simple and attractive style. In a few passages the distinctions drawn are perhaps a little too fine for the learner's comprehension, and some of the definitions are hardly plain enough; but the great number of illustrative examples aid in making the subject clearer. In its new form the book deserves a new career of usefulness.

— Statements having been made in Paris affecting the authenticity of Marie Bashkirtseff's "Journal," says *The Publishers Weekly*, M. André Theuriet writes to the *Temps* that Marie's mother brought him the whole of the journal of her daughter, from 1873 to almost the eve of her death; and he undertook, too good-naturedly, to edit it, because implored to do so, and in memory of his dear friend Bastien Lepage. He consulted the Bashkirtseff family as to the cutting-out of oft-repeated passages, childish nonsense, tedious descriptions of toilets, and unpleasant reflections upon other persons. After this pruning, there was enough of the original matter to fill two volumes.

— In the fall of 1889, as stated in *The Publishers' Weekly*, the American Secular Union, a voluntary association having for its object the complete separation of Church and State, in practice as well as in profession, and in no way committed to any system of religious belief or disbelief, offered a premium of one thousand dollars for "the best essay, treatise, or manual adapted to aid and assist teachers in our free public schools and in the Girard College for orphans, and other public and charitable institutions professing to be unsectarian, to thoroughly instruct children and youth in the purest principles of morality without inculcating religious doctrines." The committee chosen to examine the numerous manuscripts submitted in competition included Richard B. Westbrook, LL.D., president of the Secular Union, Felix Adler of New York, and Dr. D. G. Brinton of Philadelphia. On its recommendation, the prize has been equally divided between the two manuscripts considered the best. The successful authors are Rev. N. P. Gilman of West Newton, editor of the *Literary World* of Boston, and Mr. Edward P. Jackson, one of the masters of the Boston Latin School.

— Herbert Spencer's views on state socialism are contained in an article entitled "From Freedom to Bondage," which will open the April *Popular Science Monthly*. This is probably the strongest refutation of socialistic theorizing that has yet appeared. The subject of street-cleaning in large cities will be treated in the same number by Gen. Emmons Clark of New York. The article will include explicit practical suggestions for the proper performance of this important work. The battle between Professor Huxley and the defenders of theology is still going on. There will also be an essay by the Duke of Argyll, entitled "Professor Huxley on the War-Path," in which the professor is charged with treating theological questions inconsistently with his treatment of scientific subjects. "What keeps the bicycler upright?"— a question that is often asked — will be answered in an illustrated article by Charles B. Warring.

— Messrs. F. Warne & Co., New York, inform us that they will shortly issue the English edition of Major Casati's work, which will be published in two volumes, containing nearly two hundred original illustrations and several valuable maps. The period embraced by the work extends from a date prior to Gen. Gordon's appointment as governor-general of the Soudan to the return of Mr. Stanley's expedition. Major Casati, who was resident among the native tribes south of Khartoum and in various parts of Central Africa during the rise of Mahdism, gives valuable information as to the political situations there during the early stages of the revolution, and a most interesting account of the fall of Khartoum and the death of Gordon. Of the ten years of his stay in the Equatorial Provinces, he passed a series of years with Emin Pacha, whose full confidence he enjoyed; and, being the only European officer present during the latter years of Emin's governorship, he had exceptional opportunities for gaining information and forming an independent judgment on the political and other mysterious questions in connection with these provinces.

— G. P. Putnam's Sons will publish at once, in their series of Questions of the Day, "The Question of Copyright," a volume comprising the following material: (1) the text of the new copyright law of Feb. 4, 1891, which, under reciprocity arrangements, secures American copyright for aliens, and foreign copyright for Americans; (2) the text of the copyright law of July 8, 1870, now superseded; (3) the present copyright law of Great Britain; (4) the amended copyright law as recommended by the British Parliamentary Commission of 1879; (5) the amended copyright law as recommended by the British Society of Authors in 1891; (6) an analysis of the Royalty Scheme of Copyright (recommended by Mr. R. Pearsall Smith, Sir T. H. Farrer, and others); (7) the International Copyright Convention as ratified at the Berne Conference, Sept. 5, 1887; (8) report of the International Copyright Convention of South America, held at Montevideo, Jan. 11, 1889; (9) Henry Clay's report on copyright, domestic and international, Feb. 16, 1837; (10) "The Evolution of Copyright," by Brander Matthews; (11) "Literary Property," by G. H. Putnam; (12) "The Influence of International Copyright on the Price of Books," by Brander Matthews and G. H. Putnam; (13) "Copyright Monopolies, and Protection," by G. H. Putnam; (14) "The Nature and Origin of Copyright," by R. R. Bowker; (15) "Development of Statutory Copyright in England," by R. R. Bowker; (16) summary of copyright legislation in the United States; and (17) summary of the terms of copyright in the different countries of the world.

— In *Lippincott's Magazine* for April, "The Elizabethan Drama and the Victorian Novel," an article by T. D. Robb, institutes a comparison between the Elizabethan and the Victorian views of life and art. In "Yarns about Diamonds," in the same magazine, David Graham Adee relates some interesting facts about diamonds in general, and tells many stories relating to the discovery and history of some of the most famous of these gems, such as the Great Mogul," the "Braganza," the "Regent," the "Crown of the Moon," the "Star of South Africa," and many others; and Charles Morris, in an article entitled "New Africa," tells how nearly the whole African continent has been taken up by European nations.

— In *The Chautauquan* for April we note "The Intellectual Development of the English People," by Edward A. Freeman; "Life in Modern England," I., by J. Ranken Towse; "British America," by Professor A. P. Coleman; "The Referendum in Switzerland," by J. W. Sullivan; "Studies in Astronomy," VII., by Garrett P. Serviss; "Dreaming," by Flavel Scott Mines;

"What the World owes to the Arts of Persia," by S. G. W. Benjamin; "The Written Examination and Good Literature," by Mary E. Burt; "Woman as Scholar," by Katharine Lee Bates; "How to make a Wild Garden," by Mary Treat; "Woman's World in London," by Elizabeth Robbins Pennell; and "How Marriage affects a Woman's Wages or Business," by Lelia Robinson Sawtelle.

— In the first of the steamship articles in the April *Scribner*, John H. Gould says, "From the records kept in the Barge Office in New York City, it appears that ocean travel varies according to the business situation in this country. Following is an exhibit of the number of cabin passengers that arrived at this port during the years between 1881 and 1890, inclusive: 1881, 51,229; 1882, 57,947; 1883, 53,596; 1884, 59,503; 1885, 55,160; 1886, 68,742; 1887, 78,792; 1888, 86,302; 1889, 96,686; 1890, 99,189. From one point of view, at least, these figures are very striking. In 1889 there was a great show in Paris that attracted world-wide attention and interest. In the spring of that year every steamship agent announced to prospective passengers that all vessels would be crowded, and that the volume of passenger traffic between the continents would swamp the capacity of every line. But the figures speak for themselves. Viewing the increase of oceanic travel, it appears that the financial depression of 1884 kept many people at home who otherwise might have crossed the ocean. After that distressing season had passed, travel resumed its normal condition, and an increase may be noted with each year." Birge Harrison (the American artist, now in Australia) describes a kangaroo-hunt in the same issue. This curious animal has been practically exterminated in the older parts of Australia. The author says, "In some parts of Victoria they formerly outnumbered the sheep as two to one; and old shepherds have told me that it was not an uncommon thing to see the sheep and the kangaroos feeding together upon the plains, as many as two or three thousand kangaroos frequently accompanying a flock of a thousand sheep. Thus it will be seen that a 'station' which, in 1850, could barely graze five thousand sheep, can now be made to carry forty thousand without any danger of overstocking." Professor Thomas Dwight of the Harvard Medical School discusses "What is Right-handedness?" Rev. Willard Parsons, manager of the *Tribune* Fresh-Air Fund, tells the story of its growth and work for fourteen years. From the diaries of Capt. Stockton, United States Navy, and from conversations with him, Robert Gordon Butler tells the story of the remarkable Arctic cruise of the United States steamer "Thetis" in 1889, when she was sent to relieve any vessels of the North Pacific whaling-fleet in distress, to rescue shipwrecked sailors, and to erect a house of refuge at Point Barrow, the northernmost point of Alaska.

— "Lessons in Applied Mechanics," by James H. Cotterill, F.R.S., and John Henry Slade, R.N., just published by Macmillan & Co., consists in great measure of selections from the matter

contained in "Applied Mechanics," a larger treatise on the same subject, by Professor Cotterill of the Royal Naval College, Greenwich. It may therefore be described as an abridged edition of the previous work. The abridgment, however, has been completely re-arranged and re-written in fuller detail where necessary for the purpose of the work: consequently it may be considered as virtually a new book, smaller in compass and more elementary in character than the larger treatise upon which it was modelled, and to which it may serve as an introduction. To junior students of engineering, and others beginning the study of the subject, the book will prove valuable, as the plan of arrangement and method of treatment admirably adapt it to their requirements.

— Messrs. Ginn & Co. announce "Essential Uses of the Moods," by Robert P. Keep, principal Free Academy, Norwich, Conn., revised by John C. Rolfe, professor of Latin, Michigan University. The object of this pamphlet is to present in simple language the correspondences and differences in the uses of the moods in Greek and Latin. The pamphlet was first issued in 1879. A second edition was called for in 1882. From that time there was a steady sale for the little work until two years since, when the plates were melted in a fire. Other occupations of the author have delayed the preparation of a new edition until now. The delay has been in the end no disadvantage, for the pamphlet has been in various ways improved. Among the additions may be mentioned full references to the Latin and Greek grammars in most common use. These references are placed in the margins, and will bring the pamphlet into clear relation to the grammars which the pupil has used in his previous study.

— The April number of the "Annals of the American Academy of Political and Social Science" will contain an economic article by Professor Tuttle of Amherst College on "The Concept of Wealth;" also an article by Mr. F. W. Holls of New York on "Compulsory Voting as a Means of reforming Political Abuses," and one by Dr. R. P. Falkner on "The Universities of Italy."

SCIENCE

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CALENDAR OF SOCIETIES.

Anthropological Society, Washington.

March 17. — R. W. Shufeldt, The Evolution of Home Building among the Navajo Indians; Frank Baker, Platycnemism; J. Walter Fewkes, The Zemes of Santo Domingo; Z. T. Daniel, Contest of Strength between Indians, Half-Breeds, and Whites.

Biological Society, Washington.

March 21. — W. H. Dall, On the Age of the Peace Creek Bone-Beds of Florida; R. W. Shufeldt, On a Collection of Fossil Birds from the Equus Beds of Oregon; F. A. Lucas, A Point in the Anatomy of Hesperornis; F. H. Knowlton, What are Cypress Knees? H. E. Van Deman, The Recent Introduction of Date-Palms.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—All of Vol. I. of *Journal of Analytical Chemistry*, published at Easton, Penn. State price and condition. SCIENCE BOOK AGENCY, 47 Lafayette Place, New York.

WANTED—A position in a Summer School of Gymnastics to teach any one or more of the following named physical exercises, viz.: Fencing (to ladies especially), Sparring, Club Swinging, Wands, Chest Weights and Free Movements. Am prepared to offer very favorable terms to any school desiring such work. WILLIAM FINDLAY, Proprietor of Phila. Inst. of Phys. Cult., 1009 Arch Street, Philadelphia, Pa.

A COLLEGE GRADUATE—has had four years' experience in analytical laboratory and in works—desires position in chemical works, oil refinery, or paint works, or in any position where a technical chemist is needed. Address "CHEMIST," care *Science*.

A HARVARD M.A., especially interested in Natural History, would like to learn of some outdoor occupation for the summer. Remuneration a secondary object. SUMMER, *Science* Office.

A CHEMIST, taking P. G. work in the Scientific Department of one of our best colleges, would like to negotiate for some industrial position, where his knowledge would be of avail. Can furnish best of references. R. S. W., Box 691, Amherst, Mass.

WANTED—A position to teach Electrical Engineering by a student from leading English and French and U. S. science schools, or would accept position as Consulting Electrical Engineer, Electrician, etc. Very highest testimonials. London & Hartford Publishing Co., N. Y. (International Press Department.)

WANTED.—A young man in college would like a position during the summer of 1891 in some scientific work, particularly Orinthology, either as an instructor or tutor, or in making collections or accompanying some scientific expedition. Can give good references. Address HUBERT L. CLARK, Amherst, Mass.

WANTED.—A young man who has been teaching in a first-class High School desires a position in a similar institution. Is competent to teach Mathematics, Latin, Book-keeping, and the English branches. Can give highest references Address H. W. MARTHENS, 6208 Broad St., Pittsburgh, Pa.

WANTED.—A situation in a scientific house by a graduate of the scientific department of the Jersey City High School as Geologist, Mineralogist or as assistant teacher in Physics or assistant to a chemist. Best of references. E. W. PERRY, 582 Third Street, Jersey City, N. J.

WANTED.—By a medical student of three courses, a position on some war or mercantile vessel sailing between America and some foreign country, as Clerk, Assistant Physician or Druggist, or any respectable occupation. Content with a moderate remuneration. Highest commendations. W. L. S., *Science* Office.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

Will exchange a new Thomson reflecting astatic galvanometer, about 6,000 ohms, made by Clark, Muirhead & Co., London, and costing £30, with 1-9, 1-99, 1-999, shunts, lamp and scale, for a Weston voltmeter and ammeter, or arge Wheatstone bridge, dial pattern, or a portable testing outfit. Address G. A., *Science* Office, 47 Lafayette Place, New York.

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

I have a good supply of Eastern Coleoptera which I wish to exchange for species not in my collection. Melandryidae and Oedemeridae especially desired. Joe C. Thompson, Rosebank P. O., Box 73, S. I.

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1890 Seeger and Guernsey Cyclopedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost $6. David R. Lewis, Saybrook, Ill.

SCIENCE

NEW YORK, MARCH 27, 1891.

THE OYSTER QUESTION.[1]

I HAVE been asked to say a few words on the relation of scientific investigation to the great question of the preservation of the Maryland oyster. It is Professor Brooks who ought now to be addressing you, for it is chiefly concerning his work that I shall have to speak. It is nearly all of it his work; but he would not have said this himself, and for that reason, at least, I am glad to stand in his shoes to-day. It is a simple tale I have to tell. If at its close I try to point a moral, you will kindly hold me alone responsible for what I may say. No other person has at the present moment an inkling of what it is to be.

In 1879 there appeared a modest pamphlet, No. 1, of the "Studies from the Biological Laboratory of the Johns Hopkins University." Among other papers, it included one by Professor Brooks, on the development from the egg of a small animal, which, details apart, I may designate as a third or fourth or Virginian cousin of the oyster: at any rate, it and the oyster belong to the same great molluscan group of animals. This work was done in 1878. It was followed next year by a treatise on the development of some fresh-water *Mollusca;* and during the same year another member of the university endeavored, at the instigation of the Fish Commission, to discover the very youngest oysters, and learn their mode of life; to find how they grew, what they needed, and what they did, what they thrived on, and what was apt to injure them until they settled down on the bottom of our bay to fatten for Baltimore palates.

This first effort was a failure, in consequence of too great reliance upon the natural history of the oyster of the effete monarchies of the Old World. The oyster of Europe is a molly-coddled youngster, living inside his mamma's shell until he has a shell of his own. Seeking the young American oyster between the shells of its mother, Professor Rice failed to find it, as others had failed before. In the early spring of 1879, Major Ferguson, then fish commissioner of Maryland, made another appeal to Professor Brooks, and offered him aid not only from the State, but from the National Fish Commission, in order that he might study the development and life-history of the oyster. For such a study his work on the early development of other *Mollusca* had fitted him. The university trustees gave him leave of absence more than a month before the beginning of the regular holiday. Some of his colleagues assumed responsibility for due performance of the regular academic work. He went to Crisfield, where he was later in the season joined by other members of the biological department of the university.

Within twenty-four hours of the arrival of Dr. Brooks at Crisfield, two facts of fundamental importance were discovered by him, — one that the American oyster is not nursed within the shell of the parent, but, like all young Americans, shows an early independence; the other, that it was possible to take their eggs from oysters, and fertilize and rear them artificially, just as shad and trout are bred in our great fish-cultural stations on the Susquehanna and elsewhere. These two discoveries, based on previous investigation of the development of mollusks which had no commercial importance, made a new starting-point for the study of the oyster. It was impossible to catch and study in continuous development the microscopic, embryonic oyster scattered throughout the Chesapeake Bay; but once we could hatch out the oyster in the laboratory, and study its growth and life conditions, a very important step forward would be made. It was proved that we could get young oysters in incalculable numbers at a very small cost; and, far more important, an opportunity to investigate the life conditions of the young oyster would be given. To carry on the growth of the artificially hatched young oysters, a steady supply of fresh sea-water was needed. This the university provided the next year by the purchase of a small steam-engine and a complete outfit for the breeding of young oysters on a small scale. The privations endured by the morphologists of the biological laboratory in the endeavor to find out the whole life-history of the Chesapeake oyster at every stage of its growth, to find its enemies, and how to meet and beat them, were not inconsiderable. Being cast adrift on a barge on the bay during a storm was but one of their anxieties.

The seaside laboratory of the Johns Hopkins University maintained its station at Crisfield until early in July; then the men had to leave. Biologists are human, and the Crisfield mosquito is inhuman; and some rather extravagant persons assert, that, should the present state of affairs continue, the average Crisfield oyster will soon be no larger than the average Crisfield mosquito. But before the party left, they had established the two leading facts, — that the eggs of the Maryland oyster are thrown out into the bay to be fertilized at random, and that it was possible to fertilize and hatch thousands of them in a watch-glass; in fact, that in a few buckets of sea-water one could hatch enough eggs to supply spat for the whole Chesapeake Bay.

And what does that bay mean? Honestly and intelligently managed, it means untold wealth for our State. The people of Maryland have a richer heritage than the coal-fields of Pennsylvania or the silver mountains of Colorado. The two latter may, they must, become exhausted as time goes on; while, with some little wise and faithful care, the Chesapeake will bring, year after year, millions of dollars to Maryland citizens. This may seem an extravagant statement; but, if you will consider the facts, you will find that it is but sober truth.

Have you any notion of the wealth that is carried down to the Chesapeake by the rivers that flow into it? You have seen our oyster soiled by black mud, which surrounds its shells. Did you ever think what that mud meant? It is the nesting-place of the food of the oyster. This food consists of tiny plants, which find nourishment in the mud, and multiply with inconceivable rapidity.

How the oyster feeds may seem a problem. Fixed to an anchorage, how does it get its food? As seen on the "raw box," which is always "now open," the oyster is shut as close as a clam; but in its native habitat its shells are always a little apart, and microscopic waving hairs set up currents which carry the food-plants to its mouth, where they are ingulfed and afterwards digested. The oyster feeds every hour, every minute, of the day, and turns material otherwise unavailable into one of the best of human foods. Scientific work by the State and national surveys has proved that nearly three-quarters of the bay are covered by such mud, and are fitted to nourish oysters, though only a small part is oyster-bed. Why? The embryo sinks in the mud, and is smothered. To thrive, it needs merely some stones or other solid objects to serve as a resting-place.

It might seem that an increase of oysters would exhaust this supply of mud food, as the cattle of our Western ranges exhaust the bunch-grass; but the supply is inexhaustible. This mud swarms with the germs of little plants, which swim through the water, and are taken in by the oyster. It is impossible to exhaust the food-supply of the oyster; and you do not have to provide it, like the Kansas farmer, who has to grow corn and turn it into pork.

We have, then, two questions confronting us, — the preservation of our existing oyster-beds, and the making of new ones. For

[1] Address by Dr. H. Newell Martin, professor of biology, at the fifteenth anniversary of the Johns Hopkins University, Feb. 23, 1891.

the making of new oyster-beds, legislation is necessary, in order that citizens may spend the money necessary to prepare and sow them, and that they may feel sure that their investment shall be protected from theft. As to protection from theft, I am informed, on what I believe to be good authority, that a private oyster-bed, made in accordance with full provisions of the law, was robbed of 340,000 bushels of oysters last season, with no effective interference from the oyster navy.

This navy, what is it? and our laws, what are they?

Let me tell you a short story, but a true one, — a story of an oyster-steamer with some scientific students on board. On every side dredgers were violating the law. About dark each day the captain felt sufficiently braced up to make an arrest: he made for the nearest oyster-sloop, quite sure that it was breaking the law; and, as every oyster-sloop does violate the law, the captain was safe in going for the nearest. The commander of the pirate was arrested and taken before a justice of the peace, who had his office near the place of arrest. The magistrate, more likely than not a shareholder in the oyster-stealing sloop, was asked to wait until the accused person could bring his witnesses. The outraged captain answered that he could not waste the time of his scientific friends, and he therefore withdrew the charge, that they might not suffer; and this sort of thing went on day after day.

Is not this oyster navy, on the whole, a fraud, or perhaps rather a sham, — the scoff of the oyster thieves and the scorn of the whole State? Perhaps not so bad as it used to be, but even now a public scandal.

Some friends wish the university to undertake the breeding of oysters. That is purely a commercial matter, and should be done by business-men. The engagement of the proper man as manager, the hiring of laborers, the purchase of machinery, — all that is a business matter, and not university work at all.

They say, "We want to get the oyster out of politics." The university cannot take it out, though the oyster might get the university into politics, which may a merciful Providence forever forefend! You cannot get the oyster out of politics, and it would not be right to do it if you could. As oyster-catching is a chief industry of the State, the oyster question must always be a political question. The one thing necessary is to make our politicians as good as our oysters.

The fact remains that the Maryland oyster is becoming extinct. To preserve it, to maintain our heritage, needs some little honest and intelligent legislation, needs some active, instructed, and well-meaning control. Will you see to it?

RECENT ADVANCES IN MEDICINE.[1]

EMANCIPATED from the thraldom of authority in which it was fast bound for centuries, medicine has progressed with extraordinary rapidity, and even within the present generation has undergone a complete revolution. The advance has been in three directions: first, in the prevention of disease. A study of the conditions under which epidemics develop has led to the important work of sanitary science. For fifty years the watchword of the profession in this matter has been cleanliness; and clean streets, good drains, and pure water have in many towns reduced the mortality from certain diseases fifty per cent. In this department certainly medicine has achieved its greatest victories. It is a thought full of encouragement to know that such diseases as typhoid-fever and diphtheria may ultimately be stamped out, and be as rare among us as leprosy and small-pox. In this work the profession requires, and can often obtain, the intelligent cooperation of city authorities and the public. People scarcely understand how much has already been done, nor do they yet fully appreciate the possibilities of preventive medicine.

The second great advance which medicine has made relates to the knowledge which has been gained of the agents producing diseases. Dating from the studies on fermentation by Pasteur, and the early work of Lister, we have gradually learned to recognize the importance of the structures known as bacteria, which has revolutionized the practice of surgery and gynecology. To-day surgery is a new art, and hundreds now recover after operations from which hundreds previously died. The information which we now have on these subjects has been slowly and painfully acquired, here a little and there a little; but the outcome of it all is that as clean streets and good drains and pure water mean municipal health, so absolute cleanliness and absence of contamination mean in great part freedom from infection. So universally present are the infective agents, particularly of suppuration, that it is only by the most scrupulous care that the infection of wounds can be prevented; and it is now generally acknowledged that the highest type of this antisepticism is obtained, not by the use of various solutions which destroy the germs, but by such measures of cleanliness as effectually prevent the possibility of their presence. Now, the point for the public to appreciate in this whole question is that they are reaping the benefit of advances rendered possible by work done in laboratories without a thought of its application to life-saving.

The researches showing the relation of special microscopic organisms to special diseases are likely to lead to the most important results. The cultivation of the germs of disease outside of the body has enabled us to study the products of their growth, and in several instances from them to obtain materials which, when injected into an animal, act as a sort of vaccine against the disease itself. The hope of obtaining in some of the most important diseases vaccines which will bear the same relation to them as ordinary vaccine to small-pox is very reasonable, and likely ere long to be realized. In another direction, too, the recent studies of Koch have shown that in the growth of these bacilli materials are obtained which may act most powerfully upon the body, and attack the elements of the disease itself. His discovery of the action of the product of the growth of the tubercle bacilli upon tuberculous tissue ranks as one of the most remarkable of late years. His claims that this will cure early tuberculosis and lupus will, I believe, be substantiated. Great as is this fact in itself, the possibilities which it opens up to our view are still greater, and it may be safely said, that, apart altogether from the action of the lymph, no more encouraging discovery has been made in the past twenty-five years.

But I hear the householder say, "All that is very well; but Tommy gets the measles, and Mary has the mumps, and Susie gets the whooping-cough, just as my grandmother tells me her children had fifty years ago. My doctor's bills are possibly a little larger than were father's, and I know his drug bill could not have been as heavy as was mine for the last quarter." This may be perfectly true, for the millennium has not yet come; but it is perfectly true that to-day Mrs. Householder's risks have been reduced to a minimum in the necessary domestic emergencies, and her children's chances of reaching maturity have been enormously enhanced.

The third great advance has been the diffusion in the profession and among the public of the more rational ideas upon the treatment of disease. Dieting and nursing have supplanted in great part bleeding and physicking. We know now that a majority of febrile affections run a definite course, uninfluenced by drugs. We recognize daily the great fact that disease is only a modification of the normal processes of health, and that there is a natural tendency to recover. We cannot claim in the medicinal treatment of disease to have made great positive advances; still, to have learned not to do what we did is for the poor patients a great gain. The past half-century has placed only half a dozen absolutely indispensable drugs which must be used by all indiscriminately who practise the healing art.

A desire to take medicine is, perhaps, the great feature which distinguishes man from other animals. Why this appetite should have developed, how it could have grown to its present dimensions, what it will ultimately reach, are interesting problems in psychology. Of one thing I must complain, — that when we of the profession have gradually emancipated ourselves from a routine administration of nauseous mixtures on every possible occasion, and when we are able to say, without fear of dismissal, that a little more exercise, a little less food, and a little less tobacco and alcohol, may possibly meet the indications of the case — I say it is a just cause of complaint that when we, the priests, have

[1] Address by Dr. William Osler, professor of medicine, at the fifteenth anniversary of the Johns Hopkins University, Feb. 22, 1891.

left off the worship of Baal, and have deserted the groves and high places, and have sworn allegiance to the true god of science, that you, the people, should wander off after all manner of idols, and delight more and more in patent medicines, and be more than ever at the hands of advertising quacks. But for a time it must be so. This is yet the childhood of the world, and a supine credulity is still the most charming characteristic of man.

Some of the brightest hopes of humanity are with the medical profession. To it, not to law or theology, belong the promises. Disease will always be with us, but we may look forward confidently to the time when epidemics shall be no more, when typhoid shall be as rare as typhus, and tuberculosis as leprosy. Man, naturally a transgressor daily, both in ignorance and deliberately breaking the laws of health, will always need doctors; but the great group of preventable diseases will disappear. The progress will be gradual. What has been done is but an earnest of the things that shall be done. Amid many disappointments, we must not be impatient, as "science moves but slowly, slowly creeping from point to point."

BAUXITE IN ARKANSAS.[1]

THE Geological Survey of Arkansas has discovered deposits of bauxite in that State, the first considerable ones thus far found in this country. In 1887 a small deposit was discovered in Floyd County, Ga., but that is said to cover "an area of about half an acre" only.[2]

The Arkansas beds occur near the railway in the vicinity of Little Rock, Pulaski County, and near Benton, Saline County. The exposures vary in size from an acre to twenty acres or more, and aggregate something over a square mile. This does not, in all probability, include the total area covered by bauxite in the counties mentioned, for the method of occurrence of the deposits leads to the supposition that there are others as yet undiscovered by the survey.

In thickness the beds vary from a few feet to over 40 feet, with the total thickness undetermined. The average thickness is at least 15 feet.

These Arkansas deposits occur only in tertiary areas and in the neighborhood of eruptive syenites ("granites"), to which they seem to be genetically related. In elevation they occur only at and below 300 feet above tide-level, and most of them lie between 260 and 270 feet above tide. They have soft tertiary beds both above and below them at a few places, and must therefore be of tertiary age. As a rule, however, they have no covering, the overlying beds having been removed by erosion, and are high enough above the drainage of the country to be readily quarried. Erosive action has removed a part of the bauxite in some cases; but there are, in all probability, many places at which it has not yet been even uncovered.

It is pisolitic in structure, and, like all bauxite, varies more or less in color and in chemical composition. At a few places it is so charged with iron, that attempts have been made to mine it for iron ore. Some of the samples from these pits assay over 50 per cent of metallic iron. This ferruginous kind is exceptional, however. From the dark-red varieties it grades through the browns and yellow to pearl-gray, cream-colored, and milky white; the pinks, browns, and grays being the more abundant. Some of the white varieties have the chemical composition of kaolin; while the red, brown, and gray have but little silica and iron, and a high percentage of alumina. The analyses given below show that this bauxite is as good as that of France, Austria, and Ireland, for the manufacture of chemical products, for refractory material, and for the manufacture of aluminum by the Déville process. Should there be a market in this country for such material, Arkansas will be able to supply any demand that may be made for it. No use has ever been made of the Arkansas material except for road-building: indeed, it was not known what it was until January last, when the announcement was made by the State geologist in a letter to the governor.

Partial Analyses of Bauxite from Arkansas.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Alumina	55.59	57.62	58.60	55.89	44.81	62.05	55.64	51.90
Silica	10.18	11.48	3.34	5.11	33.94	2.00	10.88	16.76
Ferric oxide	6.08	1.88	9.11	19.45	1.37	1.66	1.95	3.16
Titanic oxide					2.00	3.50	3.50	3.50
Loss on ignition (water)	28.99	28.63	28.63	17.39	17.28	30.81	27.62	24.86

Average of Fourteen Partial Analyses of Bauxite from France, Austria, and Ireland.[1]

Alumina	52.7	per cent.
Silica	7.1	" "
Ferric oxide	19.1	" "
Water	16.4	" "

The above analyses made by the State Geological Survey show the composition of average samples.

[1] From analyses principally by Saint-Claire Deville given in the Ann. de Chimie et de Physique, lxi. 1861, p. 309 et seq.; Bull. Soc. Geol. de France, xvi. 1888, p. 345; Dingler's Polytechnisches Journal, 198, p. 156, and 234, p. 465; Bischof's Feuerfesten Thone, p. 194; Percy's Metallurgy, p. 183.

[1] By John C. Branner, Ph.D., State geologist of Arkansas (American Geologist, March, 1891).

[2] Transactions of the American Institute of Mechanical Engineers, xvi. p. 905.

REMOVING TASSELS FROM CORN.

EXPERIMENTS with strawberries made at the Ohio Experiment Station indicate that pollen-bearing is an exhaustive process, and that larger yields of fruit, as a rule, may be expected from those varieties which produce pollen so sparingly that a small proportion of other varieties producing pollen abundantly must be planted with them in order to insure a full crop, than from those which produce sufficient pollen for self-fertilization.

The following very interesting and valuable experiment on corn, made by the experiment station of Cornell University, at Ithaca, N.Y., gives strong support to this theory.

It has been claimed that if the tassels were removed from corn before they have produced pollen, the strength thus saved to the plant would be turned to the ovaries, and a larger amount of grain be produced. To test the effect of this theory, the following trial was made during the past season.

In the general cornfield a plot of forty-eight rows, with forty-two hills in each row, was selected for the experiment. From each alternate row the tassels were removed as soon as they appeared, and before any pollen had fallen. The remaining rows were left undisturbed. The corn was Sibley's Pride of the North, planted the last week in May in hills three feet six inches by three feet eight inches, on dry, gravelly, moderately fertile soil.

On July 21 the earliest tassels began to make their appearance in the folds of the upper leaves, and were removed as soon as they could be seen, and before they were fully developed. A slight pull was sufficient to break the stalk just below the tassel, and the removal was easy and rapid.

On July 25 the plot was gone over again for the removal of such tassels as had appeared since the previous work, and at this time by far the greater number of the tassels were removed.

On July 28, when the plot was gone over the third time, the effects of the tasselling became apparent in the increased number of silks that were visible on the rows from which the tassels had been removed.

On the 1,008 tasselled hills there were visible 591 silks; on the 1,008 untasselled, 393 silks.

On Aug. 4 the plot was gone over for the last time, but only a few tassels were found on the very latest stalks. The preponderance of visible silk on the tasselled rows was still manifest, there being at this time 3,542 silks visible on the tasselled rows, and but 2,044 on the untasselled rows. The corn was allowed to stand without cutting until ripe.

Sept. 29 to Oct. 1 the rows were cut and husked, and the stalks and ears weighed and counted, with the following results: —

	Aggregate Yield.		Comparative Yield.	
	Tassels left on.	Tassels removed.	Tassels left on.	Tassels removed.
Number of good ears	1551	2338	100	151
Number of poor ears	628	885	100	141
Number of abortive ears	2566	951	100	37
Total number of ears	4745	4174	100	88
Weight of merchantable corn (pounds)	710	1078	100	152
Weight of poor corn (pounds)	130	187	100	144
Number of stalks	4186	4228	100	101
100 stalks weighed (pounds)	83	79	100	96

It will thus be seen that the number of good ears and the weight of merchantable corn were both a little more than fifty per cent greater on the rows from which the tassels were removed than upon those upon which the tassels were left. This is not only true of the two sets of rows as a whole, but with the individual rows as well. In no case did a row upon which the tassels were left produce anywhere near as much as the tasselled rows on either side of it. In fact, the results given above are really the aggregate results of twenty-four distinct duplicate experiments, each of which alone showed the same thing as the aggregate of all.

By abortive ears is meant those sets that made only a bunch of husks, and sometimes a small cob, but no grain. It will be noticed that they were by far the most numerous on those rows from which the tassels were not removed. It will also be noticed that the total of the good, poor, and abortive ears is about fourteen per cent greater on the rows on which the tassels were left, while the weight of merchantable corn is more than fifty per cent greater on those rows from which the tassels were removed.

HEALTH MATTERS.

Action of an Infusion of Coffee on Bacteria.

IN studying the germicidal action of coffee, Dr. Luderitz made use of infusions of different degrees of concentration, varying from five to thirty grains of coffee to ten cubic centimetres of water. According to *The Sanitary News*, he mixed from four to six drops of pure culture-broth with eight to ten cubic centimetres of this infusion, and at the end of a certain time he withdrew parts of this mixture and cultivated them in gelatine. Experiment showed that the micrococcus prodigiosus dies in a ten-per-cent infusion of coffee in from three to five days, the bacillus of typhus in from one to three days, the proteus vulgaris in from two to four days, the staphylococcus aureus in from four to seven days, the streptococcus of erysipelas in one day, the bacillus of cholera in from three to four hours, the bacillus of anthrax in from two to three hours, and the spores of anthrax in from two to four weeks. In a thirty-per cent infusion of coffee the typhus bacillus dies in one day, the staphylococcus aureus in from one to three days, the bacillus of cholera in from half an hour to two hours, the bacillus of anthrax in two hours, the spores of anthrax in from two to four weeks. In a second series of experiments Luderitz studied the influence of an infusion of coffee mixed with gelatine on the development of bacteria. These experiments showed that the micrococcus prodigiosus does not vegetate in gelatine containing from three to nine per cent of coffee, the bacillus of typhus in gelatine with three per cent of coffee, the proteus vulgaris with from five to nine per cent, the staphylococcus aureus with two per cent, the streptococcus of erysipelas with one per cent, the cholera bacillus with one, and the bacillus of anthrax with 0.6 per cent. The action is the same for the different qualities of coffee, and is due, not to the caffeine, but to the products of the roasting of the coffee.

NOTES AND NEWS.

A FEW more points may be added to what was said on the Etruscan question in *Science*, Feb. 20, p. 99. M. Zanardelli has published, in the last volume of the *Bulletin de la Société d'Anthropologie de Bruxelles* (1890), a paper on the relationship of the Etruscan, Umbrian, and Oscan languages to the modern Italian. So far as the first-named goes, the resemblances are merely phonetic, as in the frequency of syllables ending in vowels. Professor Ferdinando Borsari of Naples has contributed to the last number of the *Rassegna Scientifica* a new study of the famous inscription of Menep phtah (of the nineteenth dynasty), in which the Etruscans, and, as he thinks, the Sicilians and Sardinians, are for the first time mentioned (*Etruschi, Sardi e Siculi nel* XIV° *Secolo prima dell'Era volgare*). He does not meet all the objections offered to these identifications, nor does he note the recent suggestions as to the interpretation of the inscription by Dr. Max Müller and others.

— From the annual report of the special committee of the American Society of Civil Engineers, on uniform standard time, we learn that the advantages of the 24-hour notation are beginning to be recognized in various branches of civil life. In hospitals, for example, to prevent mistakes by nurses in the administration of medicine, in recording temperatures, and in other matters, the new system is being gradually introduced; also in weather-tables and in the recording of meteorological readings: indeed, in departments where simplicity of system and accuracy are essential, the new notation is being spontaneously brought into use in many quarters. For two or three years back the Canadian Almanac has abandoned the old notation and substituted the new. It is in connection with railway service, however, that the general introduction of the 24-hour notation may mainly be looked for.

— The notion that the Welsh had in pre-Columbian times some knowledge of the American continent has for centuries found advocates, but never a competent critic. The latest is B. F. de Costa, who reprints from the *New England Historical and Genealogical Register* of January, 1891, his article on "The Pre-Columbian Voyages of the Welsh to America." He complains that the accounts of the alleged voyages of the Welsh to America about 1170 have not received the attention they merit; but Mr. De Costa aids little to this end. The passages he quotes are at second-hand and translations, and are eminently vague. They tell us at most that some sea-rover Madoc (there were many Madocs) found land in the West, and settled there. But both the date of this occurrence, and any definite information as to the land, are wanting. Why not print the originals, with a discussion of their sources? We are the more inclined to require this from a writer who dares the misleading statement that "the ancient literature of the Welsh carries us back to a period before the Christian era."

— In the "Report of the Lightning-Rod Conference" (London and New York, Spon, 1882), on p. 62, we read, "On the 13th June, 1854, the 'Jupiter' was struck by lightning. The conductors were in place; that of the mainmast which was struck went 2 metres (6 feet 6 inches) into the sea, and had at its end a ball 2 kilos in weight. After being struck the conductor had disappeared and the pieces of it were scattered everywhere." Further on, the report states that "the 'Jupiter' received no damage." There are a large number of cases on record in which the conductor is reported as destroyed or even dissipated, and yet no damage (always with the proviso noted below) occurred to the buildings or ships to which the conductors were attached. Generally it is stated that this fortunate result was in spite of the de-

struction of the rod. Would it not be more logical, in consideration of what we know of the conservation of energy, to say that the saving of damage to the building was on account of the destruction of the rod? The editor of *Science* will be glad to receive and publish pertinent accounts of lightning-stroke, that this controversy may be cleared up. But it should be borne in mind that a dissipated rod can protect only such points as lie between horizontal planes passing through its upper and lower ends, since the electrical energy comes in horizontally from the dielectric around.

— During the months of July and August, 1891, the following-named courses of instruction will be given in the summer schools of Harvard University: Anglo-Saxon, English, German, French, chemistry (4 courses), botany, geology (3 courses), physics (2 courses), physiology and hygiene, field-engineering (2 courses), physical training, and also a course of about thirty lectures concerning the methods of instruction in the several departments in which these courses belong. All of the above-named courses, except the two advanced courses in geology and those in field-engineering, are given in the college buildings at Cambridge, and are open to both men and women. The course in physiology and hygiene is expressly designed to meet the needs of teachers in the public schools. For information concerning the summer instruction in medicine, application should be made to the dean of the Harvard Medical School, Boylston Street, Boston, Mass. For circulars describing each of the summer courses in detail, application should be made to the secretary of Harvard University, Cambridge, Mass.

— As various erroneous statements have been made with regard to Dr. Nansen's Arctic expedition, the London *Times* gives the following account of what has actually been arranged. Dr. Nansen's desire is to leave Norway in February, 1892, but it is doubtful whether the special vessel which is being built will be ready by that time. Outside of Norway, not a farthing has been contributed by any one. The expedition is purely Norwegian, and will remain so. The Norwegian Government contributed 200,000 kroner; King Oscar, 20,000; twelve private individuals (all Norwegians except one Englishman, who has lived in Christiania for many years), 90,000: in all, 310,000 kroner, equal to £17,200. That, Dr. Nansen believes, will be sufficient. The ship, of course, is being specially constructed for the peculiar conditions which exist between the New Siberian Islands and the Pole. Dr. Nansen will be accompanied by probably not more than eight young men, all as stalwart and strong in physique as himself, and all equally confident of success.

— It has been shown by Dr. Marcet, according to *Nature* of March 12, that different persons respire different volumes of air to furnish to the body the oxygen required, and to yield a given weight of carbonic acid. Thus, to produce one gram of carbonic acid, three persons were found to need, on an average, 9 29, 10.51, and 11.30 litres of air respectively. The first was 23 years of age, the third 60; and no doubt the less the air required for a given combustion, the better the conditions of respiration. The influence of food on formation of carbonic acid in the body begins in the first hour after a meal, and increases for two or three hours, the period of maximum respiration of CO_2 varying in this time. After a certain time, the weight of CO_2 expired decreases more rapidly than the required volumes of air decrease. The influence of local variations of air-pressure appears in less air being needed, for a given amount of CO_2, with low pressures than with high; but the degree of the influence varies in individuals.

— It may be well to call attention again to the Royal Society of New South Wales prizes for original researches. The prizes are for the best communication (provided it be of sufficient merit) containing the results of original research or observation upon each of the following subjects: to be sent in not later than May 1, 1892, on the iron-ore deposits of New South Wales, the society's medal and £25; on the effect which settlement in Australia has produced upon indigenous vegetation, especially the depasturing of sheep and cattle, the society's medal and £25; on the coals and coal-measures of Australasia, the society's medal and £25: to be sent in not later than May 1, 1893, upon the weapons, utensils, and manufactures of the aborigines of Australia and Tasmania, the society's medal and £25; on the effect of the Australian climate upon the physical development of the Australian-born population, the society's medal and £25; on the injuries occasioned by insect pests upon introduced trees, the society's medal and £25. The competition is in no way confined to members of the society, nor to residents in Australia, but is open to all without any restriction whatever, excepting that a prize will not be awarded to a member of the council for the time being; neither will an award be made for a mere compilation, however meritorious in its way. The communication, to be successful, must be either wholly or in part the result of original observation or research on the part of the contributor. The society is fully sensible that the money value of the prize will not repay an investigator for the expenditure of his time and labor, but it is hoped that the honor will be regarded as a sufficient inducement and reward. All communications should be addressed to the honorary secretaries, 5 Elizabeth Street, Sydney, New South Wales.

— Some interesting remarks on squirrels are made by various writers in the *Zoölogist*. It is often said that squirrels are torpid during winter, but there is no really sound evidence for this view. Mr. Masefield, writing from Cheadle, Stafford, Eng , says (*Nature*, March 12), "I have seen squirrels abroad on fine days in, I think I may say, every one of the winter months ; and while pheasant-shooting near here on a sunny day (Jan. 6 last), which was about the middle of the most severe frost we have had for many years, with several inches of snow on the ground, I saw a squirrel jumping from tree to tree, before the beaters, in the most lively condition." Mr. Blagg, also writing from Cheadle, has "frequently seen squirrels abroad in the middle of the winter, when there has been deep snow on the ground and a keen frost in the air. I remember," he adds, "once seeing a squirrel abroad during a severe storm of sleet and rain in winter-time, and he appeared to be not at all inconvenienced by the rough weather." Mr. Blagg's idea is that the squirrel probably does sleep a good deal more in winter-time than in summer, as do many other wild animals, but that he has to be continually waking up and taking nourishment. The period of reproduction is unfavorable to the notion of an almost complete state of torpidity. The editor of the *Zoölogist* records that he has notes of "finding newly-born squirrels on March 21 (three young), April 9 (three young), April 26 (four young), and April 29 (two young). Those found at the end of March and beginning of April were naked and blind; those taken at the end of April were about three parts grown." According to the editor, "the old squirrels, in case of danger, remove the young from the nest, or 'drey,' to some hole in a tree, whither they carry them one by one in the mouth, just as a cat carries her kitten. One of the prettiest sights in the world is to see an old squirrel teaching a young one to jump."

— Professor Dubois of Berne, as we learn from *Nature* of March 12, has lately been studying the physiological action of electric currents and discharges; and he has some interesting observations on the human eye, which, it is known, has luminous sensations under the action of galvanic currents. Sudden variations of intensity, especially at making and breaking the circuit, produce such flashes. With a moistened plate at the nape of the neck, and a pad on the eye, a slight flash was distinctly perceived, even with a Leclanché cell of about 1.20 volts, and measuring in the galvanometer .04 of a milliampère. Raising the intensity to .5, the observer could tell which pole was applied to the eye. On the other hand, the retina responds much less readily to discharges from condensers or induction coils. Not till a capacity of 0.037 of a microfarad and a tension of 21 volts was reached was a true retinal flash perceived; and not even with 10 microfarads were the durable sensations characteristic of the two poles produced. The retina re-acts to quantity.

— A new quarterly journal is announced for publication by Macmillan & Co., *The Economic Journal*, issued under the auspices of the British Economic Association, a society which numbers among its members Professors R. M. Smith of Columbia, Taussig of Harvard, Alfred Marshall, Henry Sidgwick, and many others equally well known.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

UNIVERSITY EXTENSION AND THE UNIVERSITY OF THE FUTURE.[1]

I am requested to furnish information with reference to the university extension movement in England. It will be desirable that side by side with the facts I should put the ideas of the movement, for, in matters like these, the ideas are the inspiration of the work; the ideas, moreover, are the same for all, whereas the detailed methods must vary with different localities. The idea of the movement is its soul: the practical working is no more than the body. But body and soul alike are subject to growth, and so it has been in the present case. The English university extension movement was in no sense a carefully planned scheme, put forward as a feat of institutional symmetry: it was the product of a simple purpose, pursued through many years, amid varying external conditions, in which each modification was suggested by circumstances, and tested by experience. And with the complexity of our operations our animating ideas have been striking deeper and growing bolder. Speaking, then, up to date, I would define the root idea of "university extension" in the following simple formula: university education for the whole nation organized on a basis of itinerant teachers.

But every clause in this defining formula will need explanation and defence.

The term "university extension" has no doubt grown up from the circumstance that the movement in England was started and directed by the universities, which have controlled its operations by precisely the same machinery by which they manage every other department of university business. I do not know that this is an essential feature of the movement. The London branch presents an example of a flourishing organization directed by a committee formed for the purpose, though this committee at present acts in concert with three universities. I can conceive the new type of education managed apart from any university superintendence, only I should look upon such severance as a far more serious evil for the universities than for the popular movement.

[1] The substances of addresses delivered before the Johns Hopkins and other university audiences, by Richard G. Moulton, A.M., of Cambridge University, England.

But I use the term "university education" for the further purpose of defining the type of instruction offered. It is thus distinguished from school education, being moulded to meet the wants of adults. It is distinguished from the technical training necessary for the higher handicrafts or for the learned professions. It is no doubt to the busy classes that the movement addresses itself; but we make no secret of the fact that our education will not help them in their business, except that, the mind not being built in water-tight compartments, it is impossible to stimulate one set of faculties without the stimulus re-acting upon all the rest. The education that is properly associated with universities is not to be regarded as leading up to any thing beyond, but is an end in itself, and applies to life as a whole. And the foundation for university extension is a change, subtle but clear, that may be seen to be coming over the attitude of the public mind to higher education, varying in intensity in different localities, but capable of being encouraged where it is least perceptible,—a change by which education is ceasing to be regarded as a thing proper to particular classes of society or particular periods of life, and is coming to be recognized as one of the permanent interests of life, side by side with such universal interests as religion and politics. For persons of leisure and means, such growing demand can be met by increased activity of the universities. University extension is to be the university of the busy.

My definition puts the hope of extending university education in this sense to the whole nation without exception. I am aware that to some minds such indiscriminate extension will seem like an educational communism, on a par with benevolent schemes for redistributing the wealth of society so as to give everybody a comfortable income all round; but it surely ought not to be necessary to explain that in proposing a universal system of education we are not meaning that what each individual draws from the system will be the same in all cases. In this, as in every other public benefit, that which each person draws from it must depend upon that which he brings to it. University extension may be conceived as a stream flowing from the high ground of universities through the length and breadth of the country. From this stream each individual helps himself according to his means and his needs: one takes but a cupful, another uses a bucket, a third claims to have a cistern to himself. Every one suits his own capacity, while our duty is to see that the stream is pure, and that it is kept running.

The truth is, that the wide-reaching purpose of university extension will seem visionary or practicable according to the conception formed of education, as to what in education is essential and what accidental. If I am asked whether I think of shop-assistants, porters, factory-hands, miners, dock or agricultural laborers, women with families and constant home duties, as classes of people who can be turned into economists, physicists, literary critics, art connoisseurs, I admit that I have no such idea; but I do believe, or rather, from my experience in England I know, that all such classes can be interested in economic, scientific, literary, and artistic questions; and I say boldly that to interest in intellectual pursuits is the essential of education, in comparison with which all other educational purposes must be called secondary. I do not consider that a child has been taught to read unless he has been made to like reading. I find it difficult to think of a man as having received a classical education if the man, however scholarly, leaves college with no interest in classical literature such as will lead him to go on reading for himself. In education the interest is the life.

If a system of instruction gives discipline, method, and even originating power, without rousing a lasting love for the subject studied, the whole process is but a mental galvanism, generating a delusive activity that ceases when the connection between instructor and pupil is broken off; but if a teacher makes it his first business to stir up an interest in the matter of study, the education becomes self-continuing when teacher and pupil have parted, and the subject becomes its own educator. If, then, it be conceded that the essence of education is to interest, does it not seem a soberly practical purpose that we should open up to the whole nation without exception an interest in intellectual pursuits?

I take my stand on the broad moral ground that every human being, from the highest to the lowest, has two sides to his life,— his work and his leisure. To be without work in life is selfishness and sloth; but, if a man or woman is so entangled in routine duties as never to command leisure, we have a right to say to such persons that they are leading an immoral life. Such an individual has no claim to the title of a working-man: he is a slave. It may be cruel circumstances that have thus absorbed him in business, but that does not alter the fact: slavery was a misfortune rather than a fault to those who suffered it; but, in any case, to be content with slavery is a crime. Once get society to recognize the duty of leisure, and there is immediately a scope for such institutions as university extension that exist for the purpose of giving intellectual interests for such leisure time. The movement is thus one of the greatest movements for the "raising of the masses." With a large section of the people there is, at the present moment, no conception of "rising" in life, except that of rising out of one social rank into another. This last is of course a perfectly legitimate ambition, but it is outside the present discussion. University extension knows nothing of social distinctions. It has to do with a far more important mode of "rising" in life,— that of rising in the rank to which a man happens to belong at the moment, whether it be the rank in which he started or any other. There is a saying that all men are equal after dinner; and it is true, that while, in the material wealth we seek in our working hours, equality is a chimera, yet in the intellectual pursuits that belong to leisure there is no bar to the equality of all, except the difference of individual capacity and desire. Macaulay tells of the Dutch farmers who worked in the fields all day, and at night read the Georgics in the original. Scotch and American universities are largely attended by students who have had to engage in menial duties all the summer in order to gain funds for their high education during the winter. And every university extension lecturer, highly trained specialist as he is, will testify how his work has continually brought him into contact with persons of the humblest social condition, whom a moment's conversation has made him recognize as his intellectual equals. No one has any difficulty in understanding that in religious intercourse and experience all classes stand upon an equality; and I have spoken of the foundation for the university extension movement as being the growing recognition of education as a permanent human interest akin to religion. The experience of a few years has sufficiently demonstrated the possibility of arousing such interest: to make it universal is no more than a practical question of time, money, and methods.

But no doubt when we come to *modus operandi* the main difficulty of the movement is the diversity of the classes it seeks to approach,— diversity in individual capacity, in leisure, means, and previous training. Opposite policies have been urged upon us. Some have said, "Whatever you do, you must never lower the standard. Let the extension movement present outside the universities precisely the same education as the universities themselves are giving, however long you may have to wait for its acceptance." On the other hand, it has been urged, "You must go first where you are most needed. Be content with a makeshift education until the people are ready for something better." The movement has accepted neither of these policies, but has made a distinction between two elements of university training,— method and curriculum. So far as method is concerned, we have considered that we are bound to be not less thorough, but more thorough, if possible, than the universities themselves, in proportion as our clients work under peculiar difficulties. But in the matter of curriculum we have felt it our first duty to be elastic, and to offer little or much, as may in each case be desired. Accordingly, we have elaborated an educational unit,— the three-months' course of instruction in a single subject. This unit course we have used all the resources we could command for making as thorough in method as possible. Where more than this is desired, we arrange that more in a combination or series of such unit courses. The instruction can thus be taken by retail or wholesale, but in all cases it must be administered on the same rigorous method.

The key to the whole system is thus the unit course of three months' instruction in a single subject. The method of such a course is conveyed by the technical terms "lecture," "syllabus," "exercises," "class." The lectures are addressed to audiences as miscellaneous as the congregation of a church or the people in a street car; and it is the duty of the teacher to attract such miscellaneous audiences, as well as to hold and instruct them. Those who do nothing more than simply attend the lectures will at least have gained the education of continuous interest. It is something to have one's attention kept upon the same subject for three months together. But it may be assumed that in every such audience there will be a nucleus of students, by which term we simply mean persons willing to do some work between one lecture and another. The lectures are delivered no oftener than once a week; for the idea is not that the lectures convey the actual instruction, a great part of which is better obtained from books, but the office of the lecture is to throw into prominence the salient points of the study, and rouse the hearers to read for themselves. The course of instruction is laid down in the syllabus,— a document of perhaps thirty or forty pages, sold for a trifling sum. By referring for details to the pages of books, this pamphlet can be made to serve as a text-book for the whole course, making the teacher independent in his order of exposition of any other text-book. The syllabus assists the general audience in following the lectures without the distraction of taking notes, and guides the reading and thinking of the students during the week. The syllabus contains a set of "exercises" on each lecture. These exercises, unlike examination questions or "quizzes," are not tests of memory, but are intended to train the student to work for himself. They are thus to be done under the freest conditions,— at home, with full leisure, and all possible access to books, notes, or help from other persons. The written answers are sent to the lecturer for marginal comment, and returned by him at the "class." This class is a second meeting for students and others, at which no formal lecture is given; but there is free talk on points suggested to the teacher by the exercises he has received. The usual experience is that it is more interesting than the lecture. This weekly

routine of lecture, syllabus-reading, exercise, and class goes on for a period of twelve weeks. There is then an "examination" in the work of the course held for students who desire to take it. Certificates are given by the university, but it is an important arrangement that these certificates are awarded jointly on the result of the weekly exercises and the final examination.

The subjects treated have been determined by the demand. Literature stands at the head in popularity; history, with economy, is but little behind. All the physical sciences have been freely asked for. Art constitutes a department of work; but it is art-appreciation, not art-production. The movement has no function to train artists, but to make audiences and visitors to art-galleries more intelligent. It will be observed that the great study known as "classics" is not mentioned in this list; but it is an instructive fact that a considerable number of the courses in literature have been on subjects of Greek and Latin literature treated in English, and some of these have been at once the most successful in numbers and the most technical in treatment. I am not without hope that our English university extension may re act upon our English universities, and correct the vicious conception of classical studies which gives to the great mass of university men a more or less scholarly hold upon ancient languages, without any interest whatever in ancient literatures.

This university extension method claims to be an advance on existing systems, partly because under no circumstances does it ever give lectures unaccompanied by a regular plan of reading and exercises for students. These exercises, moreover, are designed, not for mental drill, but for stimulus to original work. The association of students with a general audience is a gain to both parties. Many persons follow regularly the instruction of the class who have not participated in the exercises. Moreover, the students, by their connection with the popular audience, are saved from the academic bias which is the besetting sin of teachers: more human interest is drawn into the study. The same effect follows from the miscellaneous character of the students who contribute exercises. High university graduates, experts in special pursuits, deeply cultured individuals who have never before had any field in which to exhibit the fruits of their culture, as well as persons whose spelling and writing would pass muster nowhere else, or casual visitors from the world of business, or young men and women fresh from school, or even children writing in round text,—all these classes may be represented in a single week's work; and the papers sent in will vary in elaborateness from a scrawl on a post-card to a magazine article or treatise. I have received an exercise of such a character that the student considerately furnished me with an index. I remember one longer still, but, as this hailed from a lunatic-asylum, I will quote it only for illustrating the diversity of the spheres reached by the movement. Study participated in by such diverse classes cannot but have an all-roundness, which is to teachers and students one of the main attractions of the movement.

But we shall be expected to judge our system by results; and, so far as the unit courses are concerned, we have every reason to be satisfied. Very few persons fail in our final examinations; and yet examiners report that the standard in university extension is substantially the same as that in the universities, our pass students being on a par with pass men in the universities, our students of "distinction" reaching the standard of honors schools. Personally I attach high importance to results which can never be expressed in statistics. We are in a position to assert that a successful course perceptibly influences the tone of a locality for the period it lasts. Librarians volunteer reports of an entirely changed demand for books, and we have even assurances that the character of conversation at "five o'clock teas" has undergone marked alteration. I may be permitted an anecdote illustrating the impression made upon the universities themselves. I once heard a brilliant university lecturer, who had had occasional experience of extension teaching, describe a course of investigation which had interested him. With an eye to business, I asked him if he would not give it in an extension course. He became grave. "Well, no," he replied, "I have not thought it out sufficiently for that;" and when he saw my look of surprise, he added, "You know, any thing goes down in college; but when I have to face your mature classes, I must know my ground well" I believe the impression thus suggested is not uncommon among experts who really know the movement.

Our results are much less satisfactory when we turn to the other side of our system, and inquire as to curriculum. It must be admitted that the larger part of our local centres can only take unit courses. There may be often a considerable interval between one course and another; or, where courses are taken regularly, the necessity of meeting popular interest involves a distracting variety of subjects; while an appreciable portion of our energies have to be taken up with preliminary half-courses, rather intended to illustrate the working of the movement than as possessing any high educational value. The most important advance from the unit course is the affiliation system of Cambridge University. By this a town that becomes regularly affiliated has arranged for it a series of unit courses, put together upon proper sequence of educational topics, and covering some three or four years. Students satisfying the lecturers and examiners in this extended course are recognized as "students affiliated" (S.A.), and can at any time enter the university with the status of second year's men, the local work being accepted in place of one year's residence and study. Apart from this, the steps in our educational ladder other than the first are still in the stage of prophecy. But it is universally recognized that this drawback is a matter solely of funds. Once let the movement command endowment, and the localities will certainly demand the wider curriculum that the universities are only too anxious to supply.

The third point in our definition was that the movement was to be organized on a basis of itinerant teachers. This differentiates university extension from local colleges, from correspondence teaching, and from the systems of which Chautauqua is the type. The chief function of a university is to teach, and university extension must stand or fall with its teachers. It may or may not be desirable on other grounds to multiply universities; but there is no necessity for it on grounds of popular education, the itinerancy being a sufficient means of bringing any university into touch with the people as a whole. And the adoption of such a system seems to be a natural step in the evolution of universities. In the middle ages the whole body of those who sought a liberal education were to be found crowded into the limits of university towns, where alone were teachers to listen to, and manuscripts to copy. The population of such university centres then numbered hundreds where to-day it numbers tens. The first university extension was the invention of printing, which sent the books itinerating through the country, and reduced to a fraction the actual attendance at the university, while it vastly increased the circle of the educated. The time has now come to send teachers to follow the

books, the ideas of the university being circulated through the country as a whole, while residence at a university is reserved as the apex only of the university system.

An itinerancy implies central and local management, and travelling lecturers who connect the two. The central management is a university, or its equivalent. This is responsible for the educational side of the movement, and negotiates for the supply of its courses of instruction at a fixed price per course.[1] The local management may be in the hands of a committee formed for the purpose, or of some local institution — such as a scientific or literary club or institute — which may care to connect itself with the universities. On the local management devolves the raising funds for the university fee and for local expenses, as well as the duty of putting the advantages of the course offered before the local community. The widest diversity of practice prevails in reference to modes of raising funds. A considerable part of the cost will be met by the tickets of those attending the lectures, the prices of which I have known to vary from a shilling to a guinea for the unit course, while admission to single lectures has varied from a penny to half a crown. But all experience goes to show that only a part of this cost can be met in this way. Individual courses may bring in a handsome profit, but, taking account over various terms and various districts, we find that not more than two-thirds of the total cost will be covered by ticket-money. And even this is estimated on the assumption that no more than the unit course is aimed at; while even for this the choice of subjects, and the chance of continuity of subject from term to term, are seriously limited by the consideration of meeting cost as far as possible from fees. University extension is a system of higher education; and higher education has no market value, but needs the help of endowment. But the present age is no way behind past ages in the number of generous citizens it exhibits as ready to help good causes. The millionnaire who will take up university extension will leave a greater mark on the history of his country than even the pious founder of university scholarships and chairs; and, even if individuals fail us, we have the common purse of the public or the nation to fall back upon.

The itinerant lecturers, not less than the university and the local management, have responsibility for the progress of the cause. An extension lecturer must be something more than a good teacher, something more even than an attractive lecturer: he must be imbued with the ideas of the movement, and ever on the watch for opportunities of putting them forward. It is only the lecturer who can maintain in audiences the feeling that they are not simply receiving entertainment or instruction which they have paid for, but that they are taking part in a public work, and are responsible for giving their locality a worthy place in a national scheme of university education. The lecturer, again, must mediate between the local and the central management, always ready to assist local committees with suggestions from the experience of other places, and equally attentive to bringing the special wants of different centres before the university authorities. The movement is essentially a teaching movement, and it is to the body of teachers I look for the discovery of the further steps in the development of popular education. For such a purpose lecturers and directors alike must be imbued with the missionary spirit, for university extension is a missionary university, not content with supplying culture, but seeking to stimulate the demand for it. This is just the point in which education in the past has shown badly in comparison with religion or politics. When a man is touched with religious ideas, he seeks to make converts; when he has views on political questions, he agitates to make his views prevail. Culture, on the other hand, has been only too often cherished as a badge of exclusiveness, instead of the very consciousness of superior education being felt as a responsibility which could only be satisfied by efforts to educate others. To infuse a missionary spirit into culture is not the least purpose of university extension.

I cannot resist the temptation to carry forward this thought from the present into the future. In university extension so described, may we not see a germ for the university of the future? I have made the foundation of our movement the growing conception of education as a permanent interest of adult life side by side with religion and politics. The change is at best only beginning: it tasks the imagination to conceive all it will imply when it is complete. To me it appears that this expanding view of education is the third of the three great waves of change the succession of which has made up our modern history. There was a time when religion itself was identified with a particular class, the clergy alone thinking out what the rest of the nation simply accepted; then came the series of revolutions popularly summed up as the Reformation, by which the whole adult nation claimed to think for itself in matters of religion, and the special profession of the clergy became no more than a single element in the religious life of the nation. Again, there has been in the past a distinct governing class, to which the rest of society submitted, until a series of political revolutions lifted the whole adult population into self-government, using the services of political experts, but making public progress the interest of all. Before the more quiet changes of the present age, the conception of an isolated learned class is giving way before the ideal of a national culture, in which universities will still be centres for educational experts; while university extension offers liberal education to all, until educationally the whole adult population will be just as much within the university as politically the adult population is within the constitution. It would appear, then, that the university of such a future would be by no means a repetition of existing types, such as Oxford or Cambridge, Harvard or Johns Hopkins. These institutions would exist, and be more flourishing than ever, but they would all be merged in a wider "University of England," or "University of America;" and just as the state means the whole nation, acting in its political capacity through municipal or national institutions, so the university would mean the whole adult nation, acting in its educational capacity through whatever institutions might be found desirable. Such a university would never be chartered; no building could ever house it; no royal personage or President of the United States would ever be asked to inaugurate it. The very attempt to found it would imply misconception of its essential character. It would be no more than a floating aggregation of voluntary associations. Like the companies of which a nation's commerce is made up, such associations would not be organized, but would simply tend to co-operate because of their common object. Each association would have its local and its central side, formed for the purpose of mediating between the wants of a locality and the educational supply offered by universities or similar central institutions. No doubt such a scheme is widely different from the ideal education of European countries, so highly organized from above that the minister of education can look at his watch and know at any moment all that is being done

[1] The Cambridge fee is £45 per course of three months.

throughout the country. On the contrary, the genius of the Anglo-Saxon race leans towards self-help. It has been the mission of the race in the past to develop self-government in religion and politics: it remains to crown this work with the application of the voluntary system to liberal education.

In indulging this piece of speculation I have had a practical purpose before me. If what I have described be a reasonable forecast for the university of the future, does it not follow that university extension, as the germ of it, presents a field for the very highest academic ambition? To my mind, it appears that existing types of university have reached a point where further development in the same direction would mean decline. In English universities the ideal is "scholarship." Scholarship is a good thing, and we produce it. But the system which turns out a few good scholars every year passes over the heads of the great mass of university students without having awakened them to any intellectual life: the universities are scholarship-factories, producing good articles, but with a terrible waste of raw material. The other main type of university enthrones "research" as its *summum bonum*. Possibly research is as good a purpose as a man can set before him, but it is not the sole aim in life. And when one contemplates the band of recruits added each year to the army of investigators, and the choice of ever minuter fields — not to say lanes and alleys — of research, one is led to doubt whether research is not one of the disintegrating forces of society, and whether ever-increasing specialization must not mean a perpetual narrowing of human sympathies in the intellectual leaders of mankind. Both types of university appear to me to present the phenomena of a country suffering from the effects of over-production, where the energies of workers had been concentrated upon adding to the sum of wealth, and all too little attention had been given to the distribution of that wealth through the different ranks of the community. Just at this point the university extension movement appears to recall academic energy from production to distribution, suggesting that devotion to physics, economics, art, can be just as truly shown by raising new classes of the people to an interest in physical and economic and æsthetic pursuits as by adding to the discoveries of science, or increasing the mass of art products. To the young graduate, conscious that he has fairly mastered the teaching of the past, and that he has within him powers to make advances, I would suggest the question whether, even for the highest powers, there is any worthier field than to work through university extension towards the university of the future.

LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

The Souring of Milk during Thunder-Storms.

IN *Science* of Sept. 19, 1890, appeared a short note on some work recently done in Italy by Professor Tolomei on the souring of milk during thunder-storms. Professor Tolomei concludes that there is a sufficient amount of ozone generated at such times to coagulate milk by a process of direct oxidation, and a consequent production of lactic acid.[1]

Similar results have been obtained by other experimenters, and some have even gone so far as to say that free oxygen, when in contact with milk, will generate enough lactic acid to coagulate its caseine.

These results are very different from some obtained in this laboratory. While working on the bacteria in milk, the idea occurred to us to find out, if possible, the truth of the somewhat widely accepted theory that milk will sour with extreme rapidity during thunder-storms. Although the statement that this is an oxidizing action had been frequently made, a Mr. Iles of Baltimore was the first, so far as I know, to perform any experiments in this direction.[1] His method was to subject milk to the action of ozone, generated by an electric spark passed through oxygen, above the milk. He found a rapid coagulation produced, which he attributed to the direct oxidizing action of the ozone.

Our method was similar to that of Mr. Iles's. A Wolff bottle was filled about one-third full of milk, and the air in the bottle displaced by pure oxygen. Through the opposite necks wires leading from a Holtz induction machine were passed into the interior, and the necks plugged tightly with cotton to prevent any escape of oxygen; ozone was then generated by passing a spark across through the oxygen from one pole to the other. In some cases, instead of the spark, a "silent discharge" of electricity from the two poles was used to generate ozone.

In all cases a second bottle was partially filled with milk, and kept as a "control;" i.e., one in which the milk is left in its normal condition.

For some of our experiments three bottles were used, — one left as a control; a second filled with milk and oxygen; while a third was filled, like the second, with milk and oxygen, and then treated with the electricity. We thus had milk under three conditions: 1. In its normal state; 2. Under the influence of free oxygen; 3. Under the influence of free oxygen plus a certain amount of ozone. The electricity, in all cases, was passed through the oxygen for at least half an hour. That a considerable quantity of ozone was generated, was shown by its odor, and strong action on starch-iodine paper. Our results were very different from those given by Iles and Tolomei. The milk treated with ozone, or simply pure oxygen, soured a little, but only a little, faster than normal milk. If the milk in the control coagulated in thirty-six hours, the milk experimented on coagulated only an hour or two earlier.

This result was very constant. In a considerable number of experiments, using milk of all degrees of sweetness, from that just from the cow to that a day or more old, the same result followed, — a slight hastening of the time of coagulation in milk treated with ozone or oxygen. Between the time of coagulation of milk treated simply with oxygen, and that treated with oxygen plus ozone, no perceptible difference could be noticed.

We had, then, in our experiments, produced a slight hastening of the time of coagulation. Was this a direct oxidation? From the fact that it required over a day to act, it seemed likely that it could not be. If, however, it were an oxidation, it ought to act as well on sterilized milk — i.e., milk in which all bacteria have been killed by heat — as on ordinary milk. We therefore, before introducing the oxygen, sterilized the milk. In this case no coagulation occurred. Milk that had been treated at two separate times, a week apart, with oxygen and ozone, was kept for over two months without the appearance of the least sign of coagulation.

Briefly summed up, then, our results were as follows :—

1. Milk, under the influence of oxygen, or oxygen and ozone, coagulates somewhat earlier than when left in its normal condition.

2. This action does not take place if the milk has been sterilized, and is kept from contact with unfiltered air.

3. It is probably, therefore, not an oxidation. The conclusion drawn from this is that the souring was simply produced by an unusually rapid growth of bacteria. The bacteria of milk are mostly aerobic, and would undoubtedly be stimulated to rapid growth by free oxygen or ozone.

If in a thunder-storm ozone is set free, as some observers claim, its action on bacteria would perhaps explain the effects produced

[1] A more extended account of Professor Tolomei's experiments is given in *Biedermann's Central-Blatt für Agriculturchemie*, 1890, p. 538.

[1] Chemical News, vol. xxxvi. p. 237.

at such times. I am inclined to think, however, that a more probable reason is to be found in the general conditions of the atmosphere preceding and during the storm. It has been found in our laboratory that bacteria growing on gelatine will multiply with unusual rapidity during warm, sultry weather. Now, these are the atmospheric conditions that usually precede and accompany thunder-storms. It seems to me most likely, therefore, that whatever rapid souring occurs is due to an unusually rapid growth of bacteria, caused by especially favorable conditions of the atmosphere.

The experience of the proprietor of a neighboring creamery confirms to a certain extent these conclusions. He finds, that, if milk is kept at a uniformly low temperature during the thunder-storm season, no trouble results from rapid souring, indicating that this souring, when it occurs, is due more to a high temperature and sultry atmosphere than to the ozone in the air. If this were a process of direct oxidation, it should take place, partially at least, at the lower temperature.

Professor Tolomei finds, also, that a slight electric current, if less than three ampères, will have a preservative effect on milk, the current being passed directly through the liquid. A current greater than three ampères will decompose the milk.

In our experiments, a current of less than one-fortieth of an ampère was sufficient to produce decomposition, with a certain amount of coagulation at each electrode. A stronger current would produce complete coagulation, with the somewhat curious result that the coagulum was strongly acid at the positive pole, and more feebly alkaline at the negative pole.

AARON L. TREADWELL.

Wesleyan University,
Middletown, Conn., March 20.

Mixed Races.

DR. F. VON LUSCHAN, in his description of the Tachtadschy (*Reisen in Lykien*, etc., Vienna, 1889), calls attention to the important fact that the Greeks of Lycia represent a mixture of two distinct types, and from these facts draws the following inference: "At first glance, it appears remarkable and hardly probable that two disparate types should remain distinct, although intermarriage has continued without interruption through thousands of years. But we must acknowledge that it would be just as remarkable if continued intercrossing should result in the production of a middle type (*Mischform*). It is true that at the present time the greater number of anthropologists appear to be of the opinion that middle forms originate wherever two distinct types live in close contact for a long time. If this is true at all, it is true only in a very limited sense, and still needs to be proven. *A priori*, we rather ought to expect that one or the other of these types would soon succumb in the struggle for existence. It would become extinct, and give way to the other type; or both types might continue to co-exist, although intercrossing might go on for centuries. They would undergo no other changes than those which each singly, uninfluenced by the other, would have undergone by the agency of physical causes." He exemplifies these opinions by statistical treatment of his cranial material, and by showing that in a single family all the extreme types which occur among the whole people are found.

Measurements of mixed Indian types give results which tally exactly with Dr. Von Luschan's views, and tend to support Kollmann's conclusions regarding the stability of cranial forms. The Bilqula (Bella Coola) of British Columbia are a mixed people, their language showing that they are of Salish affinity, while they have intermarried extensively with Athapascans and Haeltzukans. A study of the distribution of occurrence of length-width indices of their heads shows that the indices of from 79 to 81 are frequent, those about 83 rare, those of from 85 to 87 again very frequent. The first index corresponds to the most frequent one of the Haeltzukans; the last, to the most frequent one of the Athapascans of this region. If we consider the facial indices, a similar relation reveals itself. We find a greater frequency of the indices ranging about 79, a few cases ranging about 82, and many about 85. The height of body shows the same character of distribution,—a maximum about 160 centimetres, and another about 168 centimetres. If the three curves of frequency are drawn out, their correspondence is found to be so close that it cannot be due to mere accident. Other measurements do not show the same peculiarity, because those of the peoples of the coast do not differ materially from those of the peoples of the interior.

When these same curves are drawn out for the Oregonian Athapascans, it appears that the curves are also alike among themselves, while they differ fundamentally from those of the Bilqula. I give here a table of the length-width indices of the heads of the Oregonian Athapascans, Northern Californians, and crosses between the two, which will be found instructive:—

	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
Oregonian Athapascans	1	1	-	3	2	5	5	5	5	5	9	5	2	1	3	4	1
Crosses	-	-	1	-	1	1	-	-	-	-	1	-	1	-	1	-	-
Northern Californians	-	-	-	1	2	2	2	1	-	-	-	-	-	-	-	-	-

The first column shows particularly a much slower increase than we ought to expect if it represented a simple error curve; the second column shows a great variability, due to the presence of two distinct types. We see, notwithstanding the small number of cases, the maxima of the first and of the third columns clearly indicated. The asymmetry of the first column is easily explainable on the assumption of an intermixture with Californian tribes, and that therefore the indices peculiar to them occur more frequently.

On studying the single cases of these groups, it appears, that, although the characteristics of the component types become apparent by a statistical treatment of the series, they do not exist in the individual. The individuals are not representatives of one of the parent types, but mixed types; some parts of their bodies representing one type, other parts the other type. This mixture appears in a great variety of combinations. Middle types, that is, those standing between the two parent types, if found at all, are very few in number.

FRANZ BOAS.

Clark University, Worcester, Mass., March 17.

BOOK-REVIEWS.

Outlines of Psychology. By HARALD HÖFFDING. Tr. by Mary E. Lowndes. New York, Macmillan. 12°. $1.50.

THE translation of this work has not been made from the original Danish, but from the German translation. Professor Höffding, however, considers the German version a correct and adequate representation of the original, so that English readers can here obtain an accurate account of his views. The English version is natural and easy, and the author's meaning is, as a rule, plain and intelligible. The work is written with ability, and gives evidence of prolonged study of the subject in all its departments. It opens with some account of the scope and method of psychology, followed by a chapter on the relations of mind and body, and then takes up in succession the three fundamental elements of mental life,—cognition, feeling, and will,—the first of them naturally receiving the principal share of attention. The work is designed as a manual for students; but for that purpose the arrangement is bad, since the earlier chapters can hardly be understood without some previous knowledge of both psychology and philosophy. The plainness of the author's style, however, serves partly to remove this difficulty.

As regards the substance of the work, our judgment must be rather unfavorable. Professor Höffding's philosophical standpoint is that of the association school, modified somewhat by evolutionism, yet not differing essentially from that of the English writers with whom we are familiar. He attempts, indeed, to treat his subject without reference to philosophical theories, stating at the outset that psychology is a purely empirical science in no way dependent on metaphysics; yet he is not able to adhere to this position, but drops into philosophical discussion at intervals

throughout his book. In discussing the relations of mind and body, he rejects both spiritualism and materialism, and maintains the doctrine that matter and spirit are the two aspects of some third entity different from either; yet he is obliged to confess that no such third substance is known to us, so that the assumption of its existence seems to be only a way of evading a difficulty. In dealing with ideas and feelings, he endeavors, like other associationists, to derive them all from sensation; but, as the more important of them refuse to lend themselves to this interpretation, he is obliged to assume a "mental chemistry" by which sensations are transmuted into something radically different from themselves. Yet he gives no proof that any such transmutation ever takes place, so that this theory also is merely a way of evading a problem which the association principle cannot solve. In spite, however, of his predilection for the association principle, he is not able to adhere to it rigidly, but adopts some views that are inconsistent with it. This is specially apparent in his account of our notion of space, which he thinks cannot be explained by sensation and association; so that, after discussing the various theories, he ends by adopting one not essentially different from that of Kant. In short, Professor Höffding's work reflects the present unsettled and sceptical state of philosophy; and it is safe to say that such a work could not have been written thirty years ago, and that no such work will be written thirty years hence. Nevertheless, there is much in it that students of the subject will like to read, and it will doubtless stimulate thought in many who disagree with its conclusions.

Chapters on the Theory and History of Banking. By Charles F. Dunbar. New York, Putnam. 12°. $1.25.

This is an excellent book. It was originally prepared as a course of lectures to college students, and throughout the work the wants of beginners are kept in mind. Yet it is by no means confined to the mere rudiments of the subject, but contains about all the information that most readers will require. Professor Dunbar begins with the simplest cases of deposit and discount, and then proceeds to explain all the operations commonly carried on by banks, including the various kinds of loans and the issue of notes; and he succeeds in making the subject plainer than we have ever seen it made before. He devotes some space to showing the real character of the transaction known as discounting bills, and also points out the analogies that exist between notes and deposits. Numerous brief examples of banking accounts make the subject more intelligible; and the student who uses this book faithfully can hardly fail to get a good general idea of the nature and operations of a bank. After the descriptive and theoretical passages come several chapters on the history of banking, beginning with the Bank of Amsterdam, and tracing the outlines of the subject to the present day. The Banks of England, France, and Germany, with the peculiarities of each, are described, and

special attention is given throughout the book to the national banking system of the United States. The book cannot fail to be useful, not only to students, but also to men of business who wish to understand the methods of banking without being practically engaged in the work.

The French Invasion of Ireland in '98. By VALERIAN GRIBAYEDOFF. New York, Truth Seeker Company. 8°. $1.50.

THIS interesting work is not only a strong "side-light" on the times, persons, and places of which it treats, but also an important footnote to the history of Europe. It is well written and easily read; and the many authorities quoted or referred to prove that there was no lack of material from which to compile a truthful narrative of one of the many extraordinary episodes of the French Revolution. The greater events taking place at the time, Bonaparte and his doings then furnishing more than ample material for historians, crowded out or overshadowed the fact that Gen. Humbert, with a handful of French soldiers (little more than a thousand), penetrated to the heart of Ireland, held his own for several weeks against vastly superior numbers, and conquered an entire province before he was finally compelled to surrender to overwhelming odds. And the reasons why the apparently quixotic expedition failed of its purpose, or at least did not achieve a greater measure of success, are apparent to all who peruse this narrative, and at the same time consider the course of recent events in Ireland and the erratic actions of some of the present leaders in Irish political affairs.

The interest in the stirring events narrated in this volume will be enhanced by the fact that the commander of the expedition, Gen. Humbert, afterwards became an American citizen, served with honor in the war of 1812, and distinguished himself at the battle of New Orleans, where, by one of the coincidences of warfare, he found himself opposed to some of the English officers who had contributed to his defeat in Ireland.

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CALENDAR OF SOCIETIES.

Women's Anthropological Society of America, Washington.

March 28.—Mrs. Anita Newcomb McGee, History of a Communistic Sect.

Philosophical Society, Washington.

March 28.—H. Farquhar, The Commercial Growth and Import Duties of the United States (illustrated by curves); W. J. McGee, The Mississippi "Bad Lands;" R. W. Shufeldt, Indian Types of Beauty (with lantern illustrations).

Natural Science Association of Staten Island.

March 14.—Charles W. Leng, Notes on Some Species of Donacia; Arthur Hollick, Soapstone Rock from the Clove Road Outcrop.

Boston Society of Natural History.

April 1.—H. C. Ernst, The Germ-Theory of Disease (illustrated by stereopticon and exhibition of tube cultures).

Royal Meteorological Society, London.

March 18.—G. J. Symons, F.R.S., History of Rain-Gauges. It appears that Sir Christopher Wren, in 1663, designed not only the first rain-guage, but also the first recording-gauge, although the instrument was not constructed till 1670. The earliest known records of rainfall were made at the following places: Paris, 1668; Townley, Lancashire, 1677; Zurich, 1708; and Londonderry, 1711. A. W. Clayden, M.A., showed, on the screen, a number of interesting transparencies of photographs of clouds, lightning-flashes, and other meteorological phenomena.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head* FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.

WANTED.—All of Vol. I. of *Journal of Analytical Chemistry*, published at Easton, Penn. State price and condition. SCIENCE BOOK AGENCY, 47 Lafayette Place, New York.

WANTED—A position in a Summer School of Gymnastics to teach any one or more of the following named physical exercises, viz.: Fencing (to ladies especially), Sparring, Club Swinging, Wands, Chest Weights and Free Movements. Am prepared to offer very favorable terms to any school desiring such work. WILLIAM FINDLAY, Proprietor of Phila. Inst. of Phys. Cult., 1009 Arch Street, Philadelphia, Pa.

A COLLEGE GRADUATE—has had four years' experience in analytical laboratory and in works—desires position in chemical works, oil refinery, or paint works, or in any position where a technical chemist is needed. Address "CHEMIST," care *Science*.

A HARVARD M.A., especially interested in Natural History, would like to learn of some outdoor occupation for the summer. Remuneration a secondary object. SUMMER, *Science* Office.

A CHEMIST, taking P. G. work in the Scientific Department of one of our best colleges, would like to negotiate for some industrial position, where his knowledge would be of avail. Can furnish best of references. R. S. W., Box 691, Amherst, Mass.

WANTED—A position to teach Electrical Engineering by a student from leading English and French and U. S. science schools, or would accept position as Consulting Electrical Engineer, Electrician, etc. Very highest testimonials. London & Hartford Publishing Co., N. Y. (International Press Department.)

WANTED.—A young man in college would like a position during the summer of 1891 in some scientific work, particularly Orinthology, either as an instructor or tutor, or in making collections or accompanying some scientific expedition. Can give good references. Address HUBERT L. CLARK, Amherst, Mass.

WANTED.—A young man who has been teaching in a first-class High School desires a position in a similar institution. Is competent to teach Mathematics, Latin, Book-keeping, and the English branches. Can give highest references Address H. W. MARTHENS, 6208 Broad St., Pittsburgh, Pa.

WANTED.—A situation in a scientific house by a graduate of the scientific department of the Jersey City High School as Geologist, Mineralogist or as assistant teacher in Physics or assistant to a chemist. Best of references. E. W. PERRY, 582 Third Street, Jersey City, N. J.

WANTED.—By a medical student of three courses, a position on some war or mercantile vessel sailing between America and some foreign country, as Clerk, Assistant Physician or Druggist, or any respectable occupation. Content with a moderate remuneration. Highest commendations. W. L. S., *Science* Office.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

Will exchange a new Thomson reflecting astatic galvanometer, about 6,000 ohms, made by Clark, Muirhead & Co., London, and costing £30, with 1-9, 1-99, 1-999, shunts, lampand scale, for a Weston voltmeter and ammeter, or arge Wheatstone bridge, dial pattern, or a portable testing outfit. Address G. A., *Science* Office, 47 Lafayette Place, New York.

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

I have a good supply of Eastern Coleoptera which I wish to exchange for species not in my collection. Melandryidae and Oedemeridae especially desired. Joe C. Thompson, Rosebank P. O., Box 73, S. I.

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1890 Seeger and Guernsey Cyclopedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost $6. David R. Lewis, Saybrook, Ill.

SCIENCE

NEW YORK, APRIL 3, 1891.

THE MARINE BIOLOGICAL LABORATORY.

THE corps of instructors for the fourth season (1891) consists of Dr. C. O. Whitman, director, professor of zoölogy at Clark University, and editor of the *Journal of Morphology;* E. G. Gardiner, Ph.D., instructor in zoölogy. Massachusetts Institute of Technology; J. Playfair McMurrich, Ph.D., docent in zoölogy at Clark University; T. H. Morgan, Ph.D., Bruce fellow, Johns Hopkins University; W. M. Wheeler, fellow in biology, Clark University; H. C. Bumpus, assistant professor of zoölogy, Brown University; W. M. Rankin, Ph.D., instructor in zoölogy, Princeton College; Ryoiche Takano, artist; G. M. Gray, laboratory assistant; J. J. Veeder, collector.

In addition to the regular courses of instruction in zoölogy, botany, and microscopical technique, consisting of lectures and laboratory work under the direct and constant supervision of the instructors, there will be two or more courses of lectures on special subjects by members of the staff. One such course of six lectures will be given by Dr. McMurrich on the *Ctenophora* and the *Turbellaria*. Similar courses on the *Mollusca*, *Crustacea*, and *Echinodermata* will be given by Professor Bumpus and Dr. Rankin.

There will also be ten or more evening lectures on biological subjects of general interest. Among those who may contribute these lectures and take part in the discussions upon them may be mentioned, in addition to the instructors above named, the following: Dr. H. Ayers of the Lake Laboratory; Professor H. H. Donaldson, Clark University; Professor W. G. Farlow, Harvard University; Professor J. S. Kingsley, University of Nebraska; Professor W. Libbey, jun., Princeton College; Professor C. S. Minot, Harvard Medical School; Professor H. F. Osborn, Princeton College; Dr. S. Watase, Clark University; Professor E. B. Wilson, Bryn Mawr College.

The laboratory is located on the coast at Wood's Holl, Mass., near the laboratories of the United States Fish Commission. The building consists of two stories, — the lower for the use of students receiving instruction, the upper exclusively for investigators. The laboratory has aquaria supplied with running seawater, boats, a steam-launch, collecting apparatus, and dredges; it is also supplied with re-agents, glassware, and a limited number of microtomes and microscopes. By the munificence of friends, the library will be provided henceforth not only with the ordinary text-books and works of reference, but also with the more important journals of zoölogy and botany, some of them in complete series.

The laboratory for investigators will be open from June 1 to Aug. 29. It will be fully equipped with aquaria, glassware, reagents, etc., but microscopes and microtomes will not be provided. In this department there are fourteen private laboratories supplied with aquaria, running water, etc., for the exclusive use of investigators, who are invited to carry on their researches here free of charge. Those who are prepared to begin original work, but require supervision, special suggestions, criticism, or extended instruction in technique, may occupy tables in the general laboratory for investigators, paying for the privilege a fee of fifty dollars. The number of such tables is limited to ten. Applicants for them should state precisely what they have done in preparation for original work, and whether they can bring a complete outfit; viz., microscope, microtome, camera-lucida, etc. Special attention is invited to the opportunities here offered, as it is believed that they are somewhat unusual.

For the completion of any considerable piece of investigation, beginners usually require from one to three full years. It is not expected, therefore, that the holders of these tables will finish their work in a single season. The aim is rather to make a safe beginning, which will lead to good results if followed up between sessions, and renewed, if need be, for several successive years. No applications for less than the whole session can be received in this department.

The laboratory for teachers and students will be opened on Wednesday, July 8, for regular courses of seven weeks in zoölogy, botany, and microscopical technique. The number admitted to this department will be limited to thirty, and preference will be given to teachers and others already qualified. By permission of the director, students may begin their individual work as early as June 15 without extra charge, but the regular courses of instruction will not begin before July 8.

More advanced students who may wish to limit their work to special groups will have an opportunity to do so. The regular course in zoölogy, under charge of Professor Bumpus, will embrace a study of the more typical marine forms and elementary methods of microscopical technique. The laboratory work will be accompanied by lectures. The following is an outline of the course proposed: July 8–18, study of the lobster; July 18–20, (*a*) study of annelids (*Nereis*, *Serpula*, *Spirobis*, etc.), (*b*) *Balanoglossus* and *Phascolosoma*, (*c*) *Polyzoa*, (*d*) *Turbellaria;* July 20–27, study of the cœlenterates; July 27–Aug. 3, study of the mollusks (*Mya*, *Ostrea*, *Sycotypus*, *Loligo*); Aug. 3–10, echinoderms (starfish, sea-urchin, holothurian, etc.); Aug. 10–17, crustaceans (*Branchipus*, *Cyclops*, *Lernœa*, *Lepas*, *Idotea*, *Orchestia*, *Cancer*); Aug. 17–26, vertebrates (*Amphioxus*, elasmobranch, teleost).

Arrangements for instruction in botany have not yet been completed, but it is hoped that Mr. Setchell will again be able to take charge of the work in this department.

Applicants should state whether they can supply themselves with microscopes and microtomes. Microscope slides, dissecting and drawing instruments, bottles, and other supplies, to be finally taken from the laboratory, are sold at cost. The tuition fee is twenty-five dollars, payable in advance.

Further information, if desired, may be had by addressing Professor Hermon C. Bumpus, Wood's Holl, Mass.

Applications for places in either department should be addressed to Miss A. D. Phillips, secretary, 23 Marlborough Street, Boston.

Rooms accommodating two persons may be obtained near the laboratory at prices varying from two to four dollars a week, and board from four and a half to six dollars. By special arrangement, board will be supplied to members at The Homestead at five dollars a week.

A department of laboratory supply has been established in order to facilitate the work of teachers and others who desire to obtain materials for study or for classes. It is proposed to furnish, e.g., certain sponges, hydroids, starfishes, sea-urchins, marine worms, crustaceans, mollusks, and vertebrates, in good condition, at fair prices. Orders for the coming college year should be given as soon as possible. Circulars giving information, prices, etc., may be obtained by addressing the Department of Laboratory Supply, in care of the secretary.

Wood's Holl, owing to the richness of the marine life in the neighboring waters, offers exceptional advantages. It is situated on the north shore of Vineyard Sound, at the entrance to Buzzard's Bay, and may be reached by the Old Colony Railroad (two hours and a half from Boston), or by rail and boat from Providence, Fall River, or New Bedford. Persons coming by the way of Boston should buy round-trip tickets ($3.85).

The Marine Biological Laboratory is intended to continue and extend the work of the laboratory at Annisquam, carried on for six years by the Woman's Education Association, with the coöperation of the Boston Society of Natural History. The annual reports of the trustees, containing an account of its organization and work, may be obtained from the secretary.

EXPLORATION OF THE BLACK SEA.

WE learn from the *Proceedings of the Royal Geographical Society* for March that Professor Woeikof, at a recent meeting of the Society of Friends of Science of Moscow, communicated some results of the scientific exploration of the Black Sea in the Russian gunboat "Tchernomoretz" in June and July, 1890. The mean depth in the basin is 6,000 feet. The minimum depth (below 600 feet) was found in the north-west region, bounded by a line passing from Varna, in Bulgaria, to Eupatoria, on the west coast of the Crimea; and the maximum depth (7,365 feet), in the central part, between the Crimea and Anatolia. The surface temperature varies from 72° F. in the centre of the basin, to from 75° to 77° on the west and east. At a depth of from 29½ feet to 174 feet, the temperature was only 57° towards the south coast, 54° in the centre, and 52° in the north and near the west and east shores. The variation of temperature in the Black Sea is very characteristic at depths exceeding 180 feet. At this point the thermometer marks only 45°; but then the temperature begins to rise, and at a depth of 6,000 feet it is 49°. In other seas, in mean latitudes, the temperature diminishes regularly from the surface to the bottom, or rather below a certain depth it remains invariable (56° for the Mediterranean).

Another peculiarity of the Black Sea is, that at a depth of 450 feet, traces of sulphuretted hydrogen are found, the proportion of which increases so rapidly that it becomes quite sensible at 600 feet; and at 940 feet, and under, it renders animal life entirely impossible. At that depth were found only the semi-fossil shells of certain mollusks characteristic of the brackish water of the lagoons of the Black Sea and of the Caspian. They are the remains of the Pontic fauna which inhabited the Black Sea at the pliocene epoch, when this basin, still separated from the Mediterranean, and with a depth of only 3,000 feet, contained water of but feeble salinity. At the opening of the Bosporus, the waters of the Mediterranean would make their way into the Black Sea, and lead to the disappearance of the ancient fauna. The sulphuretted hydrogen, then, is only one of the products of the decomposition of these ancient organisms, the elimination of which takes place very slowly, owing to an immobility almost absolute of the water at a certain depth.

The Black Sea receives annually, by way of the Bosporus, only a thousandth part of the total volume of water in the basin, and consequently it will take a thousand years to completely renew the whole contents of the basin. It is thus easy to understand the slowness with which the deep waters participate in the circulation of the liquid mass.

THE VEGETABLE FIBRES OF TRINIDAD.

THE United States consul in Trinidad has recently forwarded to the government a report upon the vegetable fibres of that island, and gives a description of some of the most important of them.

The *maholtine* is a plant which grows wild in large quantities. It is easily cultivated by simply cutting down bushes and burning them, and scattering the seeds of the plant. One acre of good ground will produce about five thousand pounds of stalk; and this stalk, reduced to fibre, will make about eight hundred pounds. The stalk grows from eight to twelve feet, the skin or bark of which is stripped off, and steeped in cold water, eight or ten days after which the green watery substance is washed out, leaving a fibre eight to ten feet long.

The white *mahoe* (*Sterculia cariboea*), like the *maholtine*, grows wild, and may be cultivated in the same way, producing the same quality of fibre. The fibre is whiter and more silky than that of the *maholtine*, and is believed to be superior to it, although it has never been sent abroad to test its merits. A crop is reaped every seven months.

The *gumbo*, or *okra* (*Abelmoschus esculentus*), is another stalk fibre, the plant growing six to eight feet high, and producing a fibre about the same length. Cultivated on good soil, it will produce four thousand pounds of stalks, yielding as much fibre to the pound as the *maholtine* or the white *mahoe*.

The fibre of the *gumbo*, unlike those above mentioned, will not contain water, but throws it off like oil silk. A crop is harvested every seven months.

The plantain (*Musa sapientum*) will produce from five to six pounds of fibre to each stalk. The stalks grow from eight to nine feet high, and eight hundred of them may be produced on an acre of ground. The fibre is obtained by putting on two wooden rollers, and rolling and squeezing the stalks to crush the watery pores, then steeping it in water eight to ten days, and finally putting it under the same rolling process with heavier weights.

The banana (*Musa paradisiaca*) grows four to five feet high, produces two to three pounds of fibre to the stalk, and eight hundred stalks to the acre, and the crop is annual.

Ramie, or China-grass, grows very thickly, and, when once planted, sustains itself against other grass. After the first year, it can be cut every six months. The stalk grows about four feet high. It will produce an ounce of fibre to every square foot. The plant was imported into Trinidad from China for experimental purposes about three years ago, and has not yet assumed any commercial importance.

The *mahoe bord du mer* (*Paritium tiliaceum*) does not grow inland, but on the seashore. It is a stalk fibre, but, unlike the above, it branches, and the branches also produce fibre. It grows eight to fifteen feet high. Each tree will produce about half a pound of fibre, and one acre can support eight hundred trees.

Red *mahoe* (*Sterculia cariboea*) grows wild on any soil of the island, produces about eight hundred trees to the acre, grows eight to ten feet high, and then branches. The stalk and branches are both used for fibre, which is used by the natives for making rope. The crop is annual.

Rucon, or annotto, an Indian plant from South America, is a very strong fibre. One acre will support eight hundred stalks cultivated on fertile soil, and each stalk will produce about half a pound of fibre.

Black sage (*Cordia cylendros*) is a small shrub about six feet high, and produces a very strong fibre, used by the natives for making ropes. An acre of ground will support sixteen hundred plants, and they will give one-fourth of a pound of fibre to each plant.

Bois sang, or blood-wood, grows twenty-five feet high, and branches out eight to ten feet from the bottom. When tapped, the tree emits a fluid resembling blood, which produces a red stain. Both stem and branches produce fibre. About six hundred trees may be produced to the acre, and each tree will produce two to three pounds of fibre, which is used for rope-making. The fibre varies from four to six feet in length, is very tough, and would, it is said, make a superior twine for bagging. It is cut and planted every three years.

Balizier (*Hilicomea*) is a wild plant, grows on cool soil, and its presence indicates superior land. The blades, which resemble the blades of the plantain, produce the fibre; but the blades grow from the roots of the bush like a pine-apple, and they are six to ten feet long. One acre will produce about ten thousand blades, and each blade will produce half an ounce of fibre. It is a coarse fibre, not so strong as the others mentioned, but is useful for door-mats and similar purposes.

Cacao (*Theobroma*) is cultivated for its valuable fruit; but the tree, which grows fifteen or twenty feet high, is trimmed annually in the spring of the year, and the branches of each tree thus trimmed will produce half a pound of fibre, which varies from three to five feet in length. It is strong, and is used as rope for making hammocks.

Bois l'ome (*Guazuma ulmifolia*) is a straight tree. At a distance of eight or ten feet up the body of the tree, five or six branches shoot out in a circle round it; and, from this point to the top of the tree, encircling branches shoot out at the distance of about one foot apart. The lowest circle of branches are the longest, and they shorten as they ascend the tree, causing the tree to assume the shape of a sugar-loaf. Both the body and branches produce fibre. It is a straight brown fibre, and very strong, used generally for rope and twine making. Eight hundred trees may be produced to the acre, and, after the third year, will produce annually from one to two pounds of fibre to the tree.

The *Agave Mexicana* grows three or four feet high, and one

acre will support twenty-five hundred plants. After three years, each blade will produce half an ounce, or about half a pound to the plant. The crop may be reaped each succeeding year for from twelve to sixteen years without replanting. The plant becomes dry and worthless as soon as it produces a flower; but it rarely produces the flower before twelve years, and usually not before sixteen or twenty years. The plant grows wild on the island, but it is understood to have originally been brought from Mexico. The fibre is three to four feet long, fine, strong, and, it is said, would doubtless be good for textile purposes.

The *Agave Americana*, or American aloe, grows higher than the *Agave Mexicana*. It varies in height from four to five feet, and the fibre is the same length. It grows abundantly, chiefly near the seashore, and is understood to be a native of the island. The fibre is coarser than the Mexican agave, but about the same quantity can be produced to the acre.

Of the pine-apple (*Ananassa sativa*), only the blade, which is about two feet long, produces fibre. The fibre is strong and fine, and is believed to be well-suited for textile manufactures. It is of finer texture than either the American or Mexican agave.

Agave rigida, or sisal hemp, has lately been introduced into Trinidad. The blades alone, which grow about two and a half to three feet long, are used for fibre. Eight blades, it is said, give an ounce and a half of fibre, and the fibre obtained is about three feet long, strong, coarse, and stiff, suitable, it is believed, for strong ropes and chair-bottoms. An acre will support two thousand plants of about sixteen blades each, and calculated to produce at each reaping three ounces of fibre to the plant. After three years a crop is reaped annually.

Among the fibre-producing plants of Trinidad may be mentioned the *gemove* (*Malachra*); *bois ceip* (*Oreodaphne cernua*); *Gumbo mizse*, the pinquine or wild pine apple; the Spanish needle (*Yucca*); and the *Sanseviera zeylanica*.

Consul Peirce states, in conclusion, that he has been informed that there is no machine now in use in the colony which obtains the fibre without destroying the substance of the fibre-ribs. The principal machine, if not the only one, now used in Trinidad and Tobago, is arranged for the operator to hold the blade of the plant in his hand, while the machine scrapes out the green and watery substance. The opinion has been expressed that if a machine could be introduced that would act somewhat on the principle of a cane-mill, in which the cane enters one side and comes out at the other thoroughly crushed and squeezed, a great advantage would be gained over the present practice.

BETTER COWS FOR THE DAIRY.[1]

THE need of better cows for the dairy is coming to be very generally appreciated. The dairy commissioner of Iowa is reported as saying that the average cow in that State gives but 3,000 pounds of milk annually, while good ones yield from 5,000 to 6,000 pounds. The director of the Vermont Station states that the average yield per cow in that State is only about 130 pounds of butter per annum, while there are thirty dairies in the State that average over 300 pounds per cow.

The director of the New York Station says, "New York has 1,500,000 milch cows, probably producing, on an average, less than 3,000 pounds of milk per year, and the annual average butter-product per cow for the State is undoubtedly less than 130 pounds. This should not be, when there are whole herds averaging 300, and some 400, pounds of butter per year for each cow. Animals producing these by no means phenomenal yields are not confined to any particular breed, and are often grades of our so-called native or no-breed animals. Proper selection, systematic breeding, and judicious feeding have produced these profitable animals and herds."

The difference in the milk-producing qualities of different cows is brought out very clearly by a series of experiments conducted at the Massachusetts State Station, of which Professor C. A. Goessmann is director. They are especially interesting, because the cows and their feed and care were such as are found on the better farms of Massachusetts; and the results, obtained with the appliances of a well-equipped experiment station, show in accurate and full detail the elements of actual profit and loss as they could not be found in ordinary farm experience.

These experiments have been made with twelve cows, and have continued over five years. Grade Jersey, Ayrshire, Devon, Durham and Dutch, and native cows were used. They were secured for the experiments a few days after calving, and fed until the daily yield fell below 5 or 6 quarts, when they were sold to the butcher. The length of the feeding-period, i.e., duration of the experiment with each cow, varied from 261 to 599 days. Hay, fodder, corn, corn-silage, green crops, roots, and corn-meal, wheat bran, and other grain, were used. The daily ration per head consisted of 18 to 20 pounds of dry fodder, or its equivalent of green fodder, and from 6¼ to 9¼ pounds of grain. Careful accounts have been kept of the history of each cow, including breed, age, number of calves, length of feeding-period, amounts and kinds of fodder, yield of milk, chemical composition of feed, milk, and manure, cost of cow and feed, and values of milk and manure.

The following is a recapitulation of the financial record of the cows. The milk was reckoned at the price paid for it at the neighboring creameries. The value of the manure produced is calculated by assuming, that, of the total amount of food, 20 per cent would be sold with the milk, and the remaining 80 per cent saved as manure. As farmers in the region buy commercial fertilizers for the sake of their nitrogen, phosphoric acid, and potash, it was assumed that these same ingredients would be worth about as much, pound for pound, in the manure as in the better class of fertilizers, and accordingly the value of the manure was computed by taking the nitrogen as worth 16½ cents, phosphoric acid 6 cents, and potash 4½ cents, per pound. The return for feed consumed represents what the feeder receives for labor, housing of cattle, interest of capital invested, risk of loss of animal, etc.

The most profitable cow was bought for $60, fed 584 days, and then sold for $28, making her actual cost $32, and the feed cost $135.05; so that the total cash outlay was $167.05. The milk brought $203.37 at the creamery, and the manure was estimated to be worth $56.93, making the total value received for feed consumed, $260.30. Subtracting the total cash outlay of $167.05 from this, there remains $93.25 as net return for feed consumed. Deducting the estimated value of the manure, the remainder, "return in excess of estimated value of manure," is $36.32. In the average for the twelve cows, the net return was $50.43; and the return in excess of the estimated value of the manure, only $15.18. With the least profitable cow, the cash outlay for cow and feed exceeded the value of the milk and manure by $3.97: in other words, the net return for feed consumed was $3.97 less than nothing. Subtracting the value of the manure, the total loss was $84.25; that is to say, allowing for the value of the manure, the results with the twelve cows varied from a gain of $93 to a loss of $3.97, or, if the value of the manure be left out of account, from a gain of $36.32 to a loss of $84.25.

It is noticeable that the profit or loss did not depend upon either the breed or the length of the feeding-period. The most profitable cow, and the least profitable but one, were both of the same breed. Of the two most profitable cows, one was fed for 584 days, and the other for only 278 days.

Two things, then, are brought out very clearly by these experiments. One is that in such localities as this, the value of the manure goes far to decide the profit in feeding dairy cattle. Another is that cows which would ordinarily pass for good ones may differ widely in product.

To the practical dairyman these experiments teach clearly the difference between cows which are profitable and those which are not, and the importance of selecting the best cows for his dairy and getting rid of the poor ones. In a larger sense, they illustrate to every farmer the importance of knowing accurately the condition of his business. Upon this its success or failure largely depends.

[1] From Farmers' Bulletin No. 2 of the United States Department of Agriculture.

HEALTH MATTERS.

Suicide among German Children.

A curious return has been made concerning some 289 instances of suicide by school-children in the German Empire during the six years 1883 to 1888 inclusive, as we learn from the *Lancet* of Jan. 31. The interest of the return centres in the motives assigned for these extraordinary acts. Among the cases which could be so explained, the largest proportion appear to have been attributable to fear of punishment. This, perhaps, might have been expected; nor is it altogether surprising that such extreme terror should be chiefly exhibited among pupils of the elementary schools. The fact that twenty per cent of all the collected cases fall into this particular class should, however, afford food for reflection. It is certain that undue severity has been practised, or at least undue apprehension has been aroused, in every one of these instances, seeing that the little victims were so far thrown off their balance by it as to be driven to the extremity of suicide. It would be unjust to assume that for these exaggerated fears the teachers are wholly or even mainly responsible; but, on the other hand, no really efficient teacher would ever leave upon a child's mind an impression so horrible as to precipitate such a crisis as this. The child who takes his own life rather than face an angry teacher must believe, rightly or wrongly, in the ferocity of the teacher; and it is much to be feared that children of tender years, even when they are not so terror-stricken as this, are apt to nurse a suspicion that most strangers and some friends, the teacher in particular among the latter, are human wolves. To eradicate this mischievous misapprehension ought to be one of the first tasks of a successful preceptor. Among the high-school pupils the suicides are almost exclusively boys, and here the most common motive is dread or disappointment in connection with examinations. Mental derangement and thwarted ambition come next in order, while precocious sentiment claims its share to the extent of four boys and one girl, whose unhappiness is recorded as due to *une affaire de cœur*. It is some satisfaction to be able to add that these emotional young people were all past the elementary school stage.

In the *British Medical Journal*, Oct. 11, 1890, the following additional data are given: —

Of the 289 cases of suicide among school-children in Prussia, 240 of them were boys, and 49 girls. The cases are apportioned among the different years as follows: in 1883 there were 58 suicides; in 1884, 41; in 1885, 40; in 1886, 44; in 1887, 50; and in 1888, 56. In 86, or 29.8 per cent, of the cases, the motive of the deed is unknown; but in 80 the causes were fear of punishment; in 19, disappointed ambition; in 16, fear of examination; and in 28, insanity and melancholia; 5 of the suicides are attributed to love: and 7 are believed to have been half unintentional.

The Action of Koch's Liquid on the Monkey.

The effects of Koch's liquid on a quadrumanous animal so vulnerable to the invasion of the bacillus as the monkey have been investigated recently by Hénocque at the Collège de France, says the *Lancet* of March 7. M. Hénocque states that when his monkey entered the laboratory (Dec. 21, 1890), auscultation yielded no physical signs denoting phthisis. Two days after the first injection a few râles and impaired resonance were noted at the right apex. The third injection determined dulness still more marked, and, in addition, slight dulness at the left apex. From this moment all the symptoms of acute phthisis manifested themselves (cough, anorexia, debility, intense fever); and eight days later the animal died, having lost a tenth of his weight. At the necropsy four tubercular masses of the size of a big pea were discovered in the right lung, the left organ in two-thirds of its extent being the seat of caseous pneumonia. Surrounding the lesions there were zones of red hepatization, with marked exudation of red blood-corpuscles. Two guinea-pigs have been inoculated with portions of the pneumonic tissue, and both animals now present signs of cutaneous and glandular infection. The total quantity of fluid received by the monkey was six milligrams, — a quantity apparently quite capable of determining the onset of acute phthisis.

NOTES AND NEWS.

The facts derived from the study of soil-absorption at the Purdue University Agricultural Experiment Station, Lafayette, Ind., lead to the same conclusion as the results of the latest experiments on the use of fertilizers,—that, in a system of farming having in view large crops and permanent improvement of the land, phosphoric acid and potash should be used in considerably greater amounts than the crops required, while nitrogen compounds should be used in amounts not greatly in excess of the needs of the crop.

— Professor Ogata of Tokio reports a case of cholera occurring in a dog. The dog had been vomiting and purging for some time, according to the *Medical Record* of March 28, and was brought to Dr. Ogata's laboratory by a police-surgeon. After the death of the animal, several plate-cultures were made of the contents of the small intestine, from which comma bacilli were obtained in almost pure culture. Examination under the microscope, of a thin piece of the small intestine, which had been kept in alcohol and stained with gentian violet and alkaline methyl blue, showed the presence of the comma bacilli, not only on the surface of the mucous membrane, but also within Lieberkuhn's glands.

— The habits of *Brachytrypus*, the huge desert cricket of the Mediterranean region, have only recently been studied by A. Forel, although, excepting the mole crickets, it is the largest known European form. The reason appears, as we learn from *Psyche* for April, in the fact that it is a nocturnal insect, remaining in its burrows by day, and even closing the entrance to the same (although it is three or four centimetres in diameter) to an extent of several centimetres, leaving only a little sand-heap to mark its place. Dr. Forel discovered them by marking the spot where he saw and heard them chirping lustily in the dusk, and the next morning detected the heaps, carefully removing which, the burrows were found. These extended for over a metre in length, and half as much in depth; and digging the creature out was a thankless task. Dr. Forel obtained some by drowning them out, and others in a way characteristic of a myrmecologist. He secured a bag of ants, a species of *Acantholepis*, and, setting them loose before the burrow, they entered it, and soon ousted the occupant.

— In the *Lancet* of Feb. 14, Mr. J. A Wanklyn, in a note on aldepalmitic acid, says that it has long been known that the acids arising from the saponification of butter include small proportions of butyric, caproic, caprylic, and rutic acids. The larger proportion of the acids has, up to the present, been held to consist of palmitic, oleic, and stearic acids, which are non-volatile, and insoluble in water. In the course of investigations with which he has been engaged for a number of years, Mr. Wanklyn states that he has arrived at the very unexpected result that the main acid is not palmitic acid, but an acid quite distinct from palmitic acid, both in composition and properties. On the 19th of January he had the honor of reading a paper on the subject before the Society of Chemical Industry, and in due time the details will doubtless be published. In the mean time it may be of interest to mention that the new acid, which is so abundant as to amount to about half of the weight of the dry butter, differs from palmitic acid by containing less hydrogen, and that its formula is $(C_{16}H_{30}O_2)n$. The melting-point of the new acid is about 50° C., whereas palmitic acid melts at 62° C. The new acid possesses the extraordinary property of consolidating or gelatinizing alcohol. At temperatures below 5° C it gelatinizes more than five times its weight of alcohol. Part of the alcohol is held mechanically by a sponge-like action, and part is retained in chemical combination. Palmitic acid possesses no such property: indeed, no other substance does.

— The following is an abstract of a bulletin of the Ohio Experiment Station, now awaiting publication by the State printer. The oat-crop of Ohio for 1890 was one of the poorest on record: it was quite the poorest at the experiment station, owing to the attack of a peculiar disease which caused the blades to turn yellow when the oat-plants were about six inches high, and stunted their growth throughout the season. Only four out of the fifty-four differently named sorts tested by the station in 1890 yielded so much as thirty-three bushels per acre. Generally, five to eight pecks of

seed-oats have given a larger yield than a larger quantity; and drilling has been followed by better crops than broadcast seeding. An experiment in steeping seed-oats in hot water indicates that by this method the greater portion of the loss from the smut of oats may be prevented. The process, briefly stated, is as follows: have two vessels, in one of which water is kept warmed to about 120° F., and in the other to as nearly exactly 135° as possible. Have a basket of wire netting, or a loose splint basket covered with cloth. The water-baths must be large enough to admit this basket. Fill the basket with seed-grain, and immerse it in the cooler bath, keeping it there and stirring it around until all the grains are warmed; then lift it out and plunge it into the hot bath, where it should remain from eight to ten minutes, being stirred or agitated meanwhile. Then remove it and dip it into cold water, or spread the grain out and throw cold water over it, after which dry it sufficiently for sowing. The effectiveness of this method depends upon having the water hot enough to destroy the smut germs, which may be adhering to the outside of the grains of oats, but not so hot as to destroy the oat germ. The reason for using two vessels is, that if one vessel were used, the water would be cooled too much by the cold grain to accomplish the purpose in view, or, if it were heated hot enough to do this, it would be so hot as to destroy the vitality of much of the grain.

— The injury from hail in Würtemberg during the sixty years 1828–87 has been investigated by Herr Bühler. As stated in *Nature* of March 19, the yearly average of days with hail is 18; and about .92 per cent of the cultivated land was affected, damage being done to the extent of about $600,000. July had most hail (34 days); June coming next, with 30.1 days. There is no evidence of increase of hail in the course of decades. The Black Forest district seems to have specially suffered. The author makes out 17 paths of the hail-storms. One very often frequented is that on the Danube, from Scheer to Ulm (70 kilometres long and 15 broad). All the paths seem connected with the configuration of the ground, and limited in many cases by quite low heights. Slopes with a western exposure are more in danger than those with an eastern, and plains suffer much less than hilly ground. The frequently affirmed influence of forest on hail-fall is not distinctly proved by the Würtemberg data. Herr Hellmann has made a further study of the figures, and finds that in Würtemberg, as in the Rhone Department and in Carinthia, the chief maximum falls in the second half of July. A secondary one, nearly as high, occurs June 20–24. This holds also for Carinthia; while in the Rhone Department this maximum is earlier, in the first half of June.

— We have received from the Johns Hopkins Press a pamphlet containing "The History of University Education in Maryland," by Bernard C. Steiner, and an account of the origin and organization of the Johns Hopkins University, by President Gilman. Maryland has been very backward in providing for the higher education, whether general or professional, and Mr. Steiner, therefore, is unable to present so interesting a history as would be possible in some other States; but his account is straightforward and as minute as most readers will care for. President Gilman, after paying tribute to the memory of Mr. Hopkins, proceeds to explain more especially on what principles and with what objects in view the institution over which he presides was organized. He gives some account of the inauguration of the university, with extracts from the speeches made on that occasion by himself and by President Eliot of Harvard, and then briefly notes some of the main points in the university's history. The prominence of the graduate department is shown by the fact that from the first the graduate students have been nearly twice as numerous as the undergraduates, though in the last few years the undergraduates have increased the fastest.

— In answer to the query, "Do Americans love flowers?" the *Illustrated American* says that the fact of the matter is, we are not true lovers of flowers. We have imported the cult, and in time may pose as fairly faithful worshippers as we have succeeded in doing with respect to horses, dogs, and chickens. We overload our dinner-tables with roses, the florists make our ball-rooms reek with the stale smell of fading gardenias, our women decorate themselves with huge posies, and we pile wreaths upon the coffins of departed friends. This is the love of display, not the love of flowers. Look at the names our indigenous flowering plants bear. Nature has supplied us with a flora as rich as any in the world. But, with the exception of the golden-rod, we have not given our flowers names that have any pretence to being poetical,—names which show that we take any interest beyond a purely scientific one in the plants. That lovely yellow violet, with its outside petals tinted a reddish brown, which clusters on our Western foot-hills, is only known as the *Viola Nuttallii*. In countries where the wild-flowers are really appreciated, the folk would have found some more suggestive name, such as "forget-me-not," "daisy," or "our lady's slipper." To whom, outside of Boston, would *Anemone patens* suggest the large purple flowers that beautify the rugged Rockies, or that *Calochortus venustus* was the lovely plant with crocus-like flowers that whitens the plains? And yet these are the only names they bear.

— An interesting general statement of the characteristic features of the entomological, and especially coleopterological, fauna of the canton of Valais, comprising the upper valley of the Rhone, will be found in Professor Ed. Bugnion's "Introduction to Favre's Faune des Coléoptères du Valais," now publishing in quarto form in the memoirs of the Swiss Society of Natural Sciences (vol. xxxi). Mr. Bugnion, according to *Psyche*, divides the district into three regions or zones,—the lower, the sub-alpine or forest, and the alpine,—their highest levels respectively at 800, 2,000, and 2,700 metres. The sub-alpine he further subdivides into a lower forest, whose upper limit reaches 1,350 metres, and an upper forest region, the latter characterized by the prevalence of conifers and rhododendrons. These divisions, as he points out in a note, differ from those of preceding authors, though not very greatly from the latest authority. Heer in 1837, writing for the whole of Switzerland, made out seven zones, each 450 metres in height after the field (campestre) which terminated at 300 metres. The succeeding were the hill or colline, with an upper limit at 750, the mountain (1,200), sub-alpine (1,650), alpine (2,100), subnivale (2,550), and nivale (3,000). Rion in 1852 made four divisions as follows: 1. Zone of cultivation, 375–1,263 metres; 2. Zone of conifers, 1,263–2,050 metres; 3. Zone of alpine pasturage, 2,050–2,760 metres; 4. Zone of eternal snow, 2,769 metres upward. Christ in 1883 also made four divisions: 1. Lower zone up to 550 metres (700 in south Switzerland; 2. Zone of deciduous trees, 550 (or 700)–1,350 metres; 3. Zone of conifers, 1,350–2,100 metres (2,300 in central Alps); 4. Alpine zone, 2,100 (or 2,300)–3,000 metres (perpetual snow). Professor Bugnion gives a larger number of groups of specific forms, mostly *Coleoptera*, inhabiting two districts, or living under different conditions, etc., in illustration of their geographical distribution, and, after discussing at some length the geological antiquity of insects, endeavors to show from what sources the different elements of the entomological fauna of Valais were directly derived.

— The population of the city of Vienna, according to the *Journal of the Society of Arts*, London, is about 800,000, and, with the suburbs and neighborhood, over 1,000,000. The consumption of animal food in 1888 consisted of 77,512 cattle, 147,978 calves, 31,469 sheep, 37,105 head of lambs, kids, and sucking pigs, and 178,466 pigs; of meat, 189,171 metrical quintals; of game, 2,377 deer, 871 wild boars; chamois and other game, 10,221 head; hares, 201,231; pheasants, 27,048; partridges, 112,778; of poultry, 893,968 pairs of fowls and pigeons; 485,775 pairs of geese, ducks, turkeys, and capons; of fish and crayfish, 12,851 metrical quintals; of butter, oil, and fat, 35,848 metrical quintals; of eggs, 83,750,000; honey, 694 metrical quintals; rice, 13,210 metrical quintals; flour, 525,795 metrical quintals; bread, 176,437 metrical quintals; wheat, 36,288 metrical quintals; legumes, 75,102 metrical quintals; asparagus, 333 metrical quintals; cauliflowers, 4,198 metrical quintals; fruits, fresh, dried, or preserved, 256,523 metrical quintals; liqueurs, 62,500 hectolitres; wine, 361,300 hectolitres; beer, 1,039,000 hectolitres. There were also killed by the butchers for food, 6,277 horses. The price of meat per kilogram (2¼ pounds) was, beef, 18 to 66 kreutzer; pork, 32 to 82 kreutzer; veal, 20 to 70 kreutzer; mutton, 20 to 60 kreutzer. The average number of fat cattle arriving weekly was 4,765 head.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

CHANGE OF FORM AFFECTING A MAGNETIC FIELD.[1]

HITHERTO the study of a magnetic field has been the study of the so-called lines of force radiating from the poles of magnets, either electro or permanent; and, so far as magnetism has been utilized in the arts, the changes in this external field have been brought about by the movements of an armature, having for its function to determine the direction and consequent density of the field. Such is the case in the instruments used in the telegraph, the telephone, in dynamos, and in motors. Sometimes conducting wires are so mounted in the field that their movement gives rise to electric currents, which signifies that the energy producing the tension in the field is absorbed in some measure by the moving wires, and is transformed into an electric current. In each of these cases the magnet producing the field is stationary; that is, changes in the magnetic field produced by it are due to a motion external to the magnet itself, and may be that of an armature, of a moving wire, or of its own bodily change of position,— a kind which is comparable with what is called external motion in thermo dynamics, to distinguish it from internal motions, or such as take place when the body changes its form. So far as I am aware, no study has been made of the effect of changing the form of a magnetic body on its field, or of the reaction upon itself of its magnetic condition due to a periodic change of form. Of course, it has been known for a long time that the form of the magnetic field depended upon the form of the magnet itself. For a straight bar magnet, this field is familiarly known by the arrangement of iron filings forming curved lines from each pole re-entering the opposite pole. When the iron is bent into a U-form, or horseshoe magnet, the field is mostly contracted to the space between the poles. These forms of magnets have been permanent ones for the purpose for which the magnet was made.

In the case of induction-coils, whether of one form or another, the magnetic change produced by it has been and is due to the electric change produced upon it by an electric circuit provided with intermittent or alternating currents.

Within a few years, attention has been called to the nature of the external field as being a part of what is now known as the magnetic circuit, which consists of these rings or closed circuits of lines of force, all originating in the iron part of the circuit, and for conducting which iron is by far the best. The poles of the magnet are simply the parts of the iron where the lines enter and leave, and they may be in any place. Usually they are at the ends of the iron, but not necessarily so. Whenever iron is placed in the magnetic field, these lines crowd into it, as it is a much better conductor than the ether. When the iron is made into a ring form and then magnetized, there is no external polarity, and consequently no external field, provided that the iron has sufficient conducting cross-section at every part.

The following experiments have been tried, to determine what effects, if any, are produced upon a magnetic field by changing the form of the magnet. It was thought at first, that if a helix was coiled into a circle and a current was present in it, changes in its form would produce corresponding changes in the magnetic field external to the coil, especially noticeable if a flexible iron ring was enclosed in the helix so as to condense the magnetic field. This was put to the test in the following manner.

I. A coil similar to the one described above, but containing a solid ring of iron about eight inches in diameter and an inch thick, had its coil put in circuit with a reflecting galvanometer of low resistance, and at such a distance from it that magnetic fields external to its circuit could not act upon it. Another coil made about a flexible ring of iron wire was put in circuit with a battery, so as to magnetize the ring strongly. Then, with one ring parallel to the other, the flexible one was made suddenly to assume an elliptical form. Each such change in form, from one ellipse to another at right angles to it, gave a deflection of the needle to the right or left, and uniformly for a given phase of change. It was also observed that the direction of the deflection was reversed when the flexible ring was turned the other side up.

II. The same flexible ring, used in the same way, but without the current through it, gave substantially the same results. Of course, the ring was permanently magnetized, and the change might have been inferred.

III. As the same kind of motion, due to change of form, is taking place when a ring is vibrating at its harmonic rate, producing what we call sound-vibrations, it was thought probable that a magnetized ring, having a coil of wire about it in connection with a telephone, would set up vibratory currents when it was struck; and this was found to be true, for, when the coil containing the heavy iron core was put in circuit with a telephone in another room, the sound of the stroke and the pitch of the ring could plainly be heard. In the first case, the number of turns of wire was small, perhaps fifty or thereabouts. I therefore had two larger rings made, each about one foot in diameter and half an inch thick.

IV. One of these was wound with six or seven hundred turns of No. 32 wire. Before it was magnetized, it was connected with the telephone, and tested for its magnetic condition by striking. The ring could plainly be heard, which showed that it had some degree of magnetism.

V. Then about two hundred turns of coarse wire were wound upon it, and a strong current sent through it to magnetize it. After this magnetizing coil had been removed, the ring was again tested as in IV. The sound was very much louder. Indeed, the telephone could be held a foot from the ear and be heard.

VI. With the ring in V. still in circuit, the companion ring, without any wire upon it, was brought near it and struck. The sound was easily heard in the telephone circuit.

VII. This second ring was now magnetized in the same way as the first, when the magnetizing helix was removed, and experiment VI. repeated. The sound was very much louder.

VIII. The ring was now struck and moved away from the first ring by stages of an inch or two at a time. It was found possible to hear its pitch in the second circuit, when it was a yard or more away from it.

IX As the pitch of the two rings was not quite the same, the higher one was loaded so as to bring them to unison. The sound was then louder and more persistent than before. This gave evidence that it was a case of sympathetic vibration, while the former were forced vibrations.

[1] Paper presented Jan. 14, 1891, by A. Emerson Dolbear, to the American Academy of Arts and Sciences, Boston.

X. A common horseshoe permanent magnet, with legs about six inches long, had perhaps fifty ohms of No. 32 wire wound about the bend, and this was put in circuit with the telephone, and struck like a tuning-fork. The sound in the telephone was very loud; indeed, too strong to be held comfortably at the ear.

XI. A coil of wire was now put about the middle of a piece of gas-pipe, which was without permanent magnetism. The piece of pipe was about four feet long and five eighths of an inch in diameter. This, when in connection with the telephone, was struck two or three times a second with a piece of brass rod, and while being thus struck it was rotated from the magnetic meridian to a position at right angles to it. The difference in the loudness of the sound, between the position in the meridian and away from it, was very marked. It is therefore shown to be possible to determine the points of the compass with a telephone, a coil, and an iron rod.

XII. A second flexible ring was now made, about a foot in diameter, consisting of a bundle of soft iron wire, the ends being roughly braided and twisted together. The thickness of this was rather less than half an inch. This was covered by a rubber tape wound spirally round it, the better to secure stability of form and insulation. Then 4 6 ohms of No. 21 wire were wound about it its entire length, making probably a thousand turns. It was then magnetized by a current from three secondary cells having six volts, giving a magnetizing current of about thirteen hundred ampère turns, leaving it a ring magnet. The terminals were then connected with the terminals of a reflecting galvanometer with a resistance of .67 of an ohm. Very slight changes in the form of the ring, either by pulling or pushing, gave decided movements to the needle, while larger amplitude gave thirty to forty degrees' deflection.

XIII. It was noticed, also, that the direction of the current depended not only upon the direction of the motion of changing the form, but also upon the direction of the motion with reference to the normal shape of the ring. Thus, if the ring be a circle, and it be drawn into a horizontal ellipse, the current will move the galvanometer-needle, say, to the right. When it is brought back to the circular form, the current is reversed. If the motion be continued so as to produce a vertical ellipse, the current will be in the same direction as that produced at first by a motion exactly opposite in direction; so that for a complete cycle of vibratory changes four currents are generated,— two direct, and two reverse.

XIV. One of the iron rings before mentioned, a heavy one about eight inches in diameter and an inch and a half thick, having coarse wire wound upon it nearly covering the ring, was connected with the galvanometer as before, and the ring was struck by a brass rod. The needle instantly swung through a wide angle. Struck again, it moved as before, but not through so wide an angle, and a half-dozen blows knocked nearly all the magnetism out of the ring. This was then detached from the galvanometer and magnetized, as before, when it again gave the same large deflection it gave at first. The same conditions were tried with other rings, and in each case it was found that a vigorous stroke upon the ring magnet had the same destroying effect upon the magnetism as it has upon magnets having external fields.

XV. The flexible ring was now put in circuit again, and vigorously jerked with the hands. A very few such movements served to destroy nearly all the magnetism present, requiring the remagnetization of the ring.

As flexible iron rings such as I wanted were not easy to make, I procured some steel wire rope of the right size, and the ends were welded for me through the courtesy of Professor Elihu Thompson of Lynn by his electrical welding process. Such a ring about a foot in diameter allows a movement of five or six inches to one of its sides. This, when wound with four or five hundred turns of No. 22 wire, may be magnetically saturated by sending a current through the wire, leaving the ring charged. The terminals may now be connected with a proper galvanometer, and changes in the form will discharge the ring.

These experiments prove, —

1. That a change in the form of a magnet causes corresponding change of stress in the field.

2. That periodic changes in form due to elasticity of form, such as are called sound-vibrations, set up similar periodic changes or waves in the magnetic field.

3. That such sound-vibrations of a magnet act upon other magnets like sound-vibrations, and set them into corresponding vibratory movements, sympathetic or forced, — sympathetic when the receiving magnet has the same pitch as the transmitting magnet, and forced when it has not the same pitch.

4. That such sound-vibrations in the receiving-magnet cause a corresponding change of form in its magnetic field, which manifests itself by electric currents in circuits surrounding it.

Sir William Thomson has frequently said that he could understand a mechanical idea when he could make a model of it, but could not otherwise. If one assumes that the ultimate atoms of iron are magnets, as is thought most probable now, or holds, by Ampère's hypothesis, that currents of electricity circulate about each atom, making it a magnet — in either case, each individual atom has its own magnetic field, which is necessarily always with it. It is really its re-action upon the ether. If such atoms be elastic, as there is the best of reasons for believing, then it follows that impact must set them into periodic vibratory motion; that is, periodic change of form at a rate depending upon its degree of density and elasticity. Such changes of form set up corresponding periodic waves in the ether, as changes in the magnetic field; and these are transmitted outwards with a rate depending upon the properties of the ether to transmit such motions, not upon the source of the disturbance.

Such vibratory motions among atoms and molecules we call heat, and such periodic waves in the ether we call light, and thus Maxwell's idea of light being an electro magnetic phenomenon is altogether in accordance with the experiments. For waves of the lengths of light-waves, it is essential that the vibrating body be small and highly elastic. Maxwell's idea was, that the opposite phases of ether-waves could produce opposite electrical effects, so that each half-vibration represented either positive or negative conditions; and these implied, though I have not noticed the statement, that they must have originated with vibrating magnetic atoms or molecules. It has been difficult or impossible heretofore to imagine how ether-waves could be set up by vibrations of the elements, though the idea that the atoms of matter are magnets is not new at all, and has a good degree of probability.

If one is to picture to himself at all how this kind of a phenomenon can occur, he is bound to have in mind some form for an atom that shall at the same time be a consistent magnetic form. If atoms are magnets, it is well-nigh inconceivable that they should be spheres or cubes, or tetrahedra, or disks, or any of the ordinary geometric forms, for such would be very poor forms to exhibit magnetic properties. But a ring presents a very different case, as a ring magnet is the most perfect form possible. There is this to be said of such a form, however. It does not present what we commonly call a magnetic field: it is a closed circuit.

Nevertheless, I would ask if it is probable that the ether external to a magnet of that form should be quite unaffected, quite neutral. I should suppose not, but, on the contrary, should look for some sort of stress there, though it might be of somewhat different nature, and have somewhat different properties, from an ordinary magnetic field. But if such were the case, it follows that any magnetic change in the ring magnet itself would be followed by a corresponding change in the external field, and vibratory motions would necessarily set up waves in that field. Such waves would have a magnetic origin, but the waves themselves would not necessarily give rise to electro-magnetic effects directly. Indirectly they would; for, if they could make another similar magnet vibrate sympathetically, these vibrations would re-act upon its magnetic properties.

Such a ring form as I have shown suggests at once the vortex ring theory of atoms, of the properties of which I have so often spoken to the academy. Perhaps the experiments should have a different interpretation from that suggested here; but, whatever their interpretation may be, they are believed to be entirely new, and therefore of interest, if not important.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

The Audubon Monument.

AUDUBON, the great naturalist, to whom this country is as much indebted as the English people are to White of Selborne for the accurate study of natural history, died in New York in 1851, and was buried in Trinity Cemetery. His family vault was in that part of the cemetery which, subsequent to the selection of the site, became 153d Street, which the city authorities have ordered to be opened. As there was danger of the vault being interfered with by the improvements consequent on the opening of the street, the trustees of the cemetery gave the family a new plot, and built a new vault at their own expense, to which his remains were removed in 1890; but no monument marks or ever has marked his grave.

In the year 1887 the New York Academy of Sciences appointed a committee, of which I was chairman, to collect funds to erect a suitable monument over his grave. Since that time the committee have labored constantly and earnestly to collect sufficient money to erect this monument, but with no very great success. A few generous responses have been received, and a number of conditional subscriptions have been made; but, counting them all together, less than half the amount necessary for the erection of the monument, the design for which was accepted by the committee, has been raised. If every appeal which has been sent out had been responded to by the contribution of five dollars, there would have been enough to erect both a monument over his grave and one in the park beside. It still remains a fact that the grave of the greatest naturalist that this city has ever produced, of whose work Cuvier said that it was "the most magnificent monument that art had ever raised to ornithology," is not distinguished by any mark of any kind, and that the committee, after four years of unremitting labor, during which they have tried every expedient known to them to induce people to subscribe, have failed to raise the amount of money which they consider necessary for a suitable monument. The committee are well aware of how many claims there are, both for the living and the dead; but this one has certainly not met with the response which it ought to have met with. The committee do not feel that they can carry on the work of collecting, which demands so much personal labor from them, over another year, and appeal earnestly to the public to support them, so that they may finish their labors during the year 1891, and erect over the remains of this great citizen of New York a monument worthy of his genius and his fame.

THOS. EGLESTON.

New York, March 21.

The very Peculiar Tortoise, Carettochelys Ramsay, from New Guinea.

THROUGH the great kindness of Professor Ramsay, curator of the Australian Museum, Sydney, I have just received some photographs of the unique specimen of *Carettochelys*. From these I reach the conclusion that *Carettochelys* is an ancestral form of the *Trionychia*.

One of the photographs shows the upper and lower view of the posterior portion of the skull. The most pecular character of this part is the enormously developed supra-occipital spine, which is spoon-shaped. The squamosals have also developed, exactly as in the *Trionychia*, large crest-like posterior processes. They do not reach so far behind as the supra-occipital spine. The whole shape of this portion of the skull is only comparable with that of the *Trionychia*. The pterygoids extend between quadrate and basisphenoid exactly as in this group. The quadrate is not entirely closed behind, as in the *Trionychia*, but only on the outside, leaving a posterior foramen, as in the *Podocnemididæ*, for instance. The articular face of the quadrate is as in the *Trionychia*, and so is the posterior end of the lower jaw. The shape of the pterygoids is also as in the *Trionychia*, but from the photograph I cannot ascertain whether they are curved up in front, as in the *Pleurodira*, or not. There is no parieto-squamosal arch, but a post-orbital and quadrato-jugal arch is present, resembling the arrangement in the *Trionychia*. The inter-orbital space is very large, and the orbits are lateral, much as in the *Staurotypidæ* and *Cinosternidæ*. The bones of the head are sculptured exactly in the same way as the shell, a condition only found in the Jurassic *Compsemys plicatulus* Cope. The nose was projected in front. It would seem from the photographs that there was a distinct very small mesoplastral bone.

Unfortunately the cervicals of the unique specimens have not been preserved by the collector. The condition of the pelvis, and the number of the phalanges in the fourth digit, are not yet known. To judge from the photograph, the latter do not exceed three. But I think it already possible to draw conclusions about the relations of this peculiar form. I consider it an ancestral form of the *Trionychia*, which still preserves the peripheral bones, and which has the carapace and plastron completely closed. Further finds will show whether the cervicals are already of the Trionychian structure, or whether they show the condition of the *Amphichelydia* or *Pleurodira*. There are only ten peripherals on each side, as in the *Staurotypidæ*, *Cinosternidæ*, and the fossil *Anostira* and *Pseudotrionyx;* and I should not be surprised to hear that this form will prove to be very close to *Pseudotrionyx*. I also believe that the group containing the *Dermatemydidæ*, *Chelydridæ*, *Staurotypidæ*, and *Cinosternidæ* is related to the ancestral *Trionychia*.

Carettochelys cannot be placed in any group of living tortoises: it has to be considered as the representative of a peculiar group ancestral to the *Trionychia*, and in relation probably to the *Amphichelydia*. This group I propose to call *Carettochelydes*. I can only hope that other specimens of this ancestral tortoise may be collected soon. The only specimen now in existence has been caught in the Fly River, New Guinea, and is now in the Australian Museum, Sydney.

G. BAUR.

Clark University, Worcester, Mass., March 26.

American Box-Tortoises.

THROUGH the kindness of Mr. Gustave Kohn of New Orleans, La., I have received lately a specimen of the Southern box-tortoise, made known for the first time by L. Agassiz under the name of *Cistudo major*, which name has to be changed into *Terrapene major*.

As is well known, one of the generic characters of *Terrapene* (*Cistudo*) consists in the absence of the bony temporal arch. Three years ago I showed that in the common Eastern box-tortoise (*Terrapene carolina L.*) a rudimentary quadrato-jugal is present, connected with the quadrate, but not reaching the jugal (*Zool. Anz.*, No. 296, 1888). I was greatly surprised to find now that the *Terrapene major* Ag. has the bony temporal arch well developed, exactly as in *Clemmys* or *Cyclemys*, for instance. This condition was seen in all specimens (three) examined. The Southern box-tortoise, therefore, appears as the most primitive form of the American species. This is also shown by other characters. The scapula is more primitive, the digits are strongly webbed, and the cervicals are longer. The *Terrapene ornata* Ag., only found in the Central States, is the most specialized form. There is no trace of a quadrato-jugal. The post-orbital arch has become very slender, the two branches of the scapula are of the same length, the cervicals are very short, and there are only two phalanges in the digits of the fore-limb. *Terrapene carolina* L. is between the Southern and Central form. All these species have one or two distinct ossifications at the upper end of the scapula.

I give now the characters of the three species: —

Terrapene major Ag. — Quadrato-jugal well developed, touching jugal and quadrate; cervicals long; upper branch of scapula considerably longer than inner branch (endo-scapula); digits with greatly developed webs; number of phalanges of fore-limb, 2, 3, 3, 3, 2; shell elongated.

Terrapene carolina L. — Quadrato-jugal rudimentary, only connected with quadrate; cervicals shorter than in *T. major;* upper

ıch of scapula somewhat longer than inner branch (endo-ıula), but not so long as in *T. major*; digits not so much webbed n *T. major*; number of phalanges of fore-limb, 2, 3, 3, 3, 2; l not so elongated.

errapene ornata L.— Quadrato-jugal absent; cervicals very t; upper branch of scapula of the same length as inner branch lo-scapula); digits without distinct web; number of phalanges ore-limb, 2, 2, 2, 2, 2; shell rounded.

have had no opportunity yet to examine fully *Terrapene sternoides* Gray (*triunguis* Ag.) and *Terrapene mexicana* Gray. *inosternoides* is near *T. ornata*. It may perhaps show a rudi-tary quadrato-jugal and a slight reduction in the number of phalanges. I have only seen the two stuffed types of *Terrapene icana* Gray in the British Museum. They also resembled *T. ıta*. It would be very interesting to study the osteology of e forms. Besides, it is important to examine specimens from intermediate localities, like Florida and South Carolina, to see these forms agree with *T. major* and *T. carolina*.

should be very much obliged to anybody who would send me imens from different States of the country.

errapene is one of the plastic genera, and the examination great number of specimens from different localities doubtless show some interesting results. G. BAUR.

a k University, Worcester, Mass., March 27.

BOOK-REVIEWS.

Theory of Light. By THOMAS PRESTON. London and New York, Macmillan. 8°. $3.25.

VERY one who has attempted to look up the literature of any ıtific subject knows how laborious is the search through end-volumes of the Transactions and Proceedings of learned soci-and of scientific periodicals. With some branches of science ay be impossible to make a book occasionally that shall give existing state of the science; but with physical science this is ı time to time attempted, and it was the object which Professor ton had in view in producing his "Theory of Light"

was his hope, and we think it has been realized, to furnish an rate and connected account of the most important optical re-ches, from the earliest times up to the most recent date. Com-ted mathematical theories have been avoided; yet the mathe-cal theory, which is so essential, has, in an elementary form, ell as the experiments on which it is founded, been given in cient detail to enable the student who has the necessary vledge of the higher mathematics to take up with profit the nal papers recently elaborated by various English and foreign ers.

l physicists are acquainted with the important researches, ed out in the last few years by Professor Hertz, which have ed experimentally the long-suspected close connection between and electricity, and many will be glad to find in this volume ıcise account of the results of these researches.

ines of General Chemistry. By WILHELM OSTWALD. Tr. by James Walker, Ph.D. London and New York, Macmillan. 8°. $3.50.

ROFESSOR OSTWALD is professor of chemistry in the University eipzig; and the translator of this work, Dr. Walker, is assistant e chemical department of the university of Edinburgh. The or undertook to write a book which would meet the require-ts of the student who, while not intending to devote himself ıe detailed study of general chemistry, still wishes to follow ligently the progress recently made in this important branch ience. The progress to which the author refers might be said that in the physics of chemistry.

ıe book is divided into two parts, — the first, on the chemical of mass; and the second, on the chemical laws of energy. In irst part we are told of what we know about mass, of the erties of gases, of the properties of liquids, of solutions, of properties of solids, and of the theory of chemical compounds. ill be seen that nearly all these are subjects which are on the er-line between physics and chemistry; for instance, in the chapter on the properties of liquids, the author treats of their general properties, of the relations between the gaseous and liquid states, of boiling-points, of volume relations of liquids, of refraction in liquids, of rotation of the plane of polarization, of surface tension, of internal friction, and of the specific heat of liquids. In the second part, under the general heading of "The Chemical Laws of Energy," the subjects treated are, thermo-chemistry, photo-chemistry, electro-chemistry, chemical dynamics, and chemical affinity.

The amount of progress that has been made of late years in these physico-chemical researches is considerable, and we are fortunate in having the results brought together and summarized in so good a book. The author is to be commended for having avoided one error which many a writer is induced to make. Few chemists have had much mathematical training, so that they would find it difficult or impossible to follow the mathematical discussion of physical problems. In such cases Professor Ostwald has not sought to introduce a laborious proof based on elementary mathematics, but has chosen to give simply the result.

Die Kosmologie der Babylonier. By P. JENSEN. Strassburg, 1890.

Die Fluthsagen. By RICHARD ANDREE. Braunschweig, 1891.

THE study of comparative mythology is constantly teaching us how wide spread over the earth's surface are the same infantile explanations of natural phenomena. As soon as a tribe reaches a certain stage of intellectual culture, — and that by no means a high one, — it is sure to frame some theory, under the guise of a narrative or story, to account for the existence of the world about it.

One of the most ancient, and for that reason most interesting, of these stories of creation, is that of the Babylonians, of which we have a new and very accurate rendering by Jensen. It is a part of his general work on the cosmology of the Babylonians, the whole of which is characterized by great learning and acuteness. He refutes satisfactorily the opinion of those who have maintained that the creation legend of Babylon was derived from the "Sumerian" column of the inscriptions, though their opinion would have amounted to little if Halévy's suggestion is correct, that the Sumerian script is merely an esoteric alphabet of the general Semitic language of the country.

Jensen's comparison of the Babylonian creation myth with that contained in the first part of the Book of Genesis illustrates with additional force how closely the biblical text follows the older and more detailed Euphrates myth. "In both narratives (Babylonian and biblical) the sequence of events is absolutely the same. A greater similarity would deserve the name of a translation. The Bible has taken up the Babylonian creation legends, suppressing what was specifically Babylonian, and transforming what was mythologic and polytheistic into a monotheistic form" (p. 306).

In the Babylonian legend the Creator appears as *Marduk*, who is probably a personification of the morning sun (the light-bringer), who rises over the boundless ocean (*tiamat*), conquers the chaos of night, and separates the heavens above from the earth beneath.

Jensen also supplies a more accurate translation of the Babylonian flood-myth, correcting a number of errors in Professor Haupt's rendering, and adding valuable suggestions concerning the original text. Thus, the hero of the myth, referred to by Haupt and others as *Samas-napistim* (the "Sun of Life"), is transliterated by Jensen *Sit-napistim* ("he whose life was saved"), a much more appropriate appellation. The biblical story of Noah and the Flood is, as is well known, merely a version of the Babylonian myth.

The origin, distribution, and affiliation of the flood myths all over the world are the topics discussed by the well-known ethnologist, Dr. Richard Andrée, in his "Fluthsagen." It is an interesting collection of material, but scarcely up to what we might expect from so widely read an authority. The portions on America are particularly weak. He depends for the Algonquin flood myth on Squier's inaccurate reproduction of the "Walum-Olum," evidently not knowing Brinton's elaborate reproduction and translation of that unique record. Nor does he refer to the

same author's analysis of the American flood myths in his "Myths of the New World."

We do not expect much from European writers when they deal with American subjects; but certainly Andrée should have turned to Jensen's work, rather than to Haupt's, for his version of the Babylonian myth.

Passing over these shortcomings in his authorities, the scheme of the volume is satisfactorily carried out. After narrating briefly the myths from the various continents, he shows that they have no one common origin, though many are borrowed from others, as the biblical is borrowed from the Babylonian. The natural events that prompted their invention are described at some length; but the psychological elements at the base of many of them are not adverted to. While his work is thus a useful contribution to the subject, it falls short in several important points of what it should be.

AMONG THE PUBLISHERS.

AMONG the contents of *Outing* for April, 1891, may be mentioned "Whaling among the Esquimaux," by H. L. Aldrich; "The Athletics of Ancient Greece," by Dr. Harold Williams; "Evolution in Yacht-Building," by Capt. M. Roosevelt Schuyler; and "Composite Photography," by W. I. Lincoln Adams.

— In *The Atlantic Monthly* for April, we note Mr. Lowell's "Noto: An Unexplored Corner of Japan," and Francis Parkman's second paper on "The Capture of Louisbourg by the New England Militia." One of the most important papers in the number is "Prehistoric Man on the Pacific Coast," by Professor George Frederick Wright of Oberlin, in which he gives us the results of his investigations on the subject of the Nampa Image. The Hon. S. G. W. Benjamin, for some years United States minister to Persia, has a timely consideration of "The Armenians and the Porte."

—"The Soldier's First Aid Handbook," by Capt. and Assistant Surgeon William D. Dietz, U.S.A., just published by John Wiley & Sons, consists in the main of a series of lectures delivered to members of the hospital corps and company bearers, and covers the ground indicated in existing army orders. No claim is made for originality, but the author has succeeded in presenting his subject in the form best adapted for his purpose, and in a manner calculated to make it useful to the medical officer in the preparation of his lectures to enlisted men. The work will also be of use to line officers, who, in command of detachments, may have to meet emergencies in the absence of the surgeon.

— Mr. Francis A. Shoup has published a work entitled "Mechanism and Personality," in which he endeavors to harmonize the latest biological theories with the metaphysics of Kant and Lotze. We cannot say, however, that the work is very successful, the author's ideas being too vague and confused, and his views on some points too uncertain. Thus he includes under the term "personality" not only the mind, but the body, and he repeatedly confounds the relation between the mind and its various states with that between the one and the many. Indeed, he expressly says that this conception of the mind is the keynote of his book, which is obviously a mistake. The relation between the mind and its states is that of substance and attribute, and not that of number. Other examples of confused and mistaken thought might easily be pointed out; yet the book contains some good points, and is much simpler in style than the majority of philosophical works. It is published by Ginn & Co.

— The February number (No. 49) of the Riverside Literature Series (published quarterly during the present school year at 15 cents a single number, by Houghton, Mifflin, & Co., Boston) contains Part I. of "Hans Andersen's Stories," newly translated. This book contains eleven stories, among which are "The Ugly Duckling," "The Princess on the Pea," "The Little Match-Girl," and "The Constant Tin Soldier." The publishers have felt that too little attention has been paid hitherto to the importance of bringing to children of the lowest-reader grades as good literature as has been supplied for the higher grades, and with this end in view they have this year issued the numbers of the Riverside Literature Series especially for the second-reader grade. To quote from the account of Andersen and his work in the preface of the translator, "It is this nice sympathy held by Andersen with the peculiar phase of childhood which makes his writings so eminently fit for the reading of children: in entering his world they do not pass out of their own, but enlarge it, for by the means of his art they are introduced to the larger art of imaginative literature."

— Messrs. Houghton, Mifflin, & Co. announce that they have recently published an entirely new Atlantic portrait of Mr. James Russell Lowell. This new portrait replaces one which, although a favorite for some years, is not now a good likeness of Mr. Lowell. The new portrait is from a photograph taken by Gutekunst in 1889, and is an almost full-face likeness of the poet, the head being slightly turned towards the left.

— In view of the approaching centennial of the founding of the Patent Office in Washington, James Shepard's article, "The United States Patent System," in the *New England Magazine* for April, will be of interest to many. Mr. Shepard's article sheds light upon many of the knotty points which make our patent laws such a mystery to inventors, and such a gold-mine to their legal advisers. The article urges with special strenuousness the crying necessity of extending the existing facilities of the Patent Office, and enlarging the staff of this much-overburdened department.

— Some years ago, while prosecuting investigations along scientific lines, which resulted in a number of publications in English and in German, Professor Gore of the Columbian University experienced in reading technical German those difficulties which usually come to students who have studied only literary German. In the absence of any adequate aid for acquiring proficiency in the former style, he decided to prepare a handbook for technical German, and during repeated residences in Germany he collected material. In the light of this experience, he has prepared a "German Science Reader," which will be issued next month by D. C. Heath & Co. This book will contain an introductory chapter on the peculiarities of construction of technical German, followed by a graded collection of short essays on all branches of science, with notes, and a vocabulary of scientific words.

— The April number of the *Quarterly Journal of Economics* will contain two articles on the application of the doctrine of economic rent to capital and labor as well as to land,— one by Professor J. B. Clark of Smith College, and the other by J. A. Hobson of London, — the two writers having come to similar results independently and simultaneously. Professor Adolph Wagner of Berlin contributes an important article on Marshall's "Principles of Economics," and Dr. William Cunningham reviews Gross's work on the "Gild Merchant." There will be an unusual number of shorter articles and communications, the regular bibliography, and a survey of the social and economic legislation of the several States in 1890, prepared by W. B. Shaw of Albany.

— Messrs. Macmillan & Co. will shortly be issuing Landor's "Imaginary Conversations," in six volumes, the first to be issued in April, and the remainder at intervals. It is hoped that the whole publication will be completed by December. The edition is by Mr. C. G. Crump, who edited the "Pericles and Aspasia" for the Temple Library Series. The text will be a reprint from the complete edition of Landor's works published in 1876, compared with previous editions, and a bibliography is added to each conversation showing the various forms in which it was originally published. There will be short explanatory notes. A limited edition on large paper will also be published.

— In *The Century* for April, in the California Series, Mr. Julius H. Pratt gives a description of the emigration to California by way of Panama in '49. The pictures are striking, having been drawn by Gilbert Gaul, after originals made from life by an artist in 1850. In this connection is a paper of historical value by the late Gen. J. C. Frémont on his own part in the "Conquest of California." Several briefer papers on the general subject accompany the more important contributions of the series. In this number *The Century's* Mountain-Climbing Series, appropriate to the summer season, is begun, with papers on two separate expeditions

to Mount St. Elias, one expedition being that of Lieut. Schwatka, and the other that of the National Geographic Society and the United States Geological Survey. "Fetishism in Congo Land" is by Mr. E. J. Glave, one of Stanley's pioneer officers In Topics of the Time the following subjects are discussed: cheap money, the effect of Christian science and mind-cure on the regular practice, and country roads. There will be found in Open Letters a little article by L. Clarke Davis of the *Philadelphia Ledger* on Willard, the new English actor; and a popular review of recent experiments and discoveries of Pasteur, Koch, and others, written by Dr. Mary Putnam Jacobi of New York.

— P. Blakiston, Son, & Co., the medical publishers of Philadelphia, announce for early publication "A Handbook of Local Therapeutics," being a practical description of all those agents used in the local treatment of disease, such as ointments, plasters, powders, lotions, inhalations, suppositories, bougies, tampons, etc., and the proper methods of preparing and applying them. That the various uses of each remedy may be thoroughly set forth, the following gentlemen have assumed the authorship: Harrison Allen, M.D., emeritus professor of physiology in the University of Pennsylvania, laryngologist to the Rush Hospital for Consumption, late surgeon to the Philadelphia and St. Joseph's Hospitals; George C. Harlan, M.D., late professor of diseases of the eye in the Philadelphia Polyclinic and College for Graduates in Medicine, surgeon to the Wills Eye Hospital, and Eye and Ear Department of the Pennsylvania Hospital; Charles B. Penrose, M.D., surgeon to the German Hospital, instructor in clinical surgery, University of Pennsylvania; and Arthur van Harlingen, M.D., professor of diseases of the skin in the Philadelphia Polyclinic and College for Graduates in Medicine, late clinical lecturer on dermatology in Jefferson Medical College, dermatologist to the Howard Hospital. Each remedy will be taken up in alphabetical order, and, after a description of their pharmaceutical properties by Dr. George I. McKelway, will be considered with reference to the local treatment of the affections above outlined.

— In the April *Magazine of American History* the frontispiece is a copy of the painting of "Columbus at the Court of Ferdinand and Isabella." The leading article, "The Chesapeake and Lieut. Ludlow," by Robert Ludlow Fowler, brings to light some unpublished letters about the naval engagements of the war of 1812. A short sketch of the first meeting of Admiral Porter and Gen. Sherman, as described by the admiral, will attract many. The essay of Hon. William Wirt Henry, "A Defence of Capt. John Smith," takes the reader into the beginnings of Virginia Life. "A Bundle of Suggestive Relics," by Hon. Horatio King, presents a curious exhibit of partisanship in the olden time. "The Power to grant Patents for Inventions," by Levin H. Campbell, gives the proceedings of the framers of the Constitution in 1787, in that line. "President Lincoln and his English Visitors," is a paper containing some readable anecdotes. "The Fate of a Pennsylvania Coquette," penned more than half a century ago by Mrs. E. F. Ellet; "Two Immortal Letters" of Grant and Sherman, and a "Love-Letter of Alexander Hamilton, written to Elizabeth Schuyler a few Weeks before their Marriage," in 1780; and an informing contribution on "Archæology in Missouri," — close the number.

— Messrs. P. Blakiston, Son, & Co. have issued a second edition of Leffmann & Beam's "Examination of Water for Sanitary and Technical Purposes." Since the publication of the first edition, many processes for water-analysis have been proposed, and these have been included in the present revision, so far as they seemed to be of substantial value. The authors particularly mention among these new methods those recommended by the chemical section of the American Association, and the application of the Kjeldahl process to the determination of organic nitrogen. The section on biological examinations has been considerably extended; and the authors believe that while it would be impossible to overestimate the importance of bacteriology in certain departments of science, yet that until pathogenic microbes are more nearly indicated and described the methods will be of little use in dealing with the problem of the determination of the sanitary and technical value of water-supplies. A chapter is devoted to the purification of water, in which are described in some detail the more important systems.

— The Ocean Steamship Series begins in the April number of *Scribner's Magazine*. The following articles have been arranged for, all to be fully illustrated: "Ocean Passenger Travel," by John H. Gould; "The Ship's Company," by Lieut. J. D. Jerrold Kelly, U.S.N.; "Safety at Sea," by W. H. Rideing; "Speed in Ocean Steamships," by A. E. Seaton; and "Ocean Steamship Lines of the World."

— Messrs. Longmans, Green, & Co. have issued Hjelt's "Principles of General Organic Chemistry," translated by J. Bishop Tingle. This book is intended for students who have some general knowledge of organic chemistry, and who wish to extend and systematize that knowledge. Part I. is devoted to the composition, constitution, and classification of organic compounds; Part II., to illustrating the connection between the constitution of such compounds and their chief physical properties; and Part III. deals with the chemical behavior of organic compounds. The book is intended as a supplement to, rather than as a substitute for, ordinary text-books.

— A book that will be useful in the laboratory of many scientific men has recently been published by Norman W. Henley, New York, entitled "Rubber Hand Stamps and the Manipulation of Rubber." The author is T. O'Conor Sloane, Ph.D. The object of the book is to present in simple form the methods of manipulation of India-rubber. To mould and cure the mixed gum, but few appliances are needed, and these can be made at home. For some reason the methods of moulding the material are not generally known; and while the futility of attempting to melt and cast it has been taught many by sad experience, yet India-rubber is the most plastic of materials when properly treated.

— A cable despatch to the *Publishers' Weekly*, dated Paris, March 24, says, "M. Aulard, professor of history at the Sorbonne, impeaches the authenticity of the 'Talleyrand Memoirs.' He argues, that, from internal evidence, parts of the papers have been suppressed, and that the gaps have been clumsily concealed. He suggests that the work was done by Bacourt to screen the reputation of Talleyrand or of royal personages, as the published version of the memoirs does not account for the prohibition of their publication for so many years. The Duc de Broglie gives an evasive reply to M. Aulard's challenge to produce the original manuscript."

— Professor Knoflach publishes through G. E. Stechert his "Sound-English Primer," in which he applies the methods of his former book, "Sound-English: The Language of the World," although he has much simplified his system of types and turned letters, and now uses only the accepted English lettering. The little stories of which the primer consists are first printed in phonetic spelling, and are then given in regular spelling, that the child may learn to reason and understand the different combinations of sound made by the different combinations of letters. The author thinks children will learn to read by this new method in less than half the time now required.

— "How to meet Hereditary Physical Traits in Children" is the subject of a series of brief papers begun in *Babyhood* for April. Other articles in this number are "Tuberculous Joint Diseases in Children," and "Objects and Methods of the Bath." Minor topics are, "Disturbed Sleep," "Early Singing," "Quality of the Teeth," "Hives," etc.

— One of the most recent of the Elementary Science Manuals, published by Longmans, Green, & Co., is "Practical, Plane and Solid Geometry," by I. H. Morris. Among the special features of the work, the following may be mentioned. The subject is so arranged that, as far as possible, similar problems are grouped together; the diagrams face the text relating to them; a very large number of examples are fully worked out; the notes are numerous; and there are an abundance of exercises appended. These exercises, which are carefully selected, are nicely graduated; and hints for solution, and references to the problems upon which they depend, are given. The concluding chapter of the book is devoted to graphic arithmetic.

INDUSTRIAL NOTES.

The Crocker-Wheeler Motors.

THE Crocker-Wheeler Electric Motor Company of this city are now turning out a line of motors which, in point of excellence, both mechanically and electrically, leave little to be desired in the present stage of electrical development. These motors are so designed and constructed that they do their rated work at a much slower speed than has been possible heretofore, and without the hitches and troubles frequently incident to the use of electrical machinery.

In the accompanying illustrations, Fig. 1 is a skeleton view showing the construction of a motor of small size, one-horse-power and under. Figs. 2 and 3 show an indestructible resistance-box, made entirely of iron and slate, and used in starting, stopping, and regulating the speed of the motors.

The field-magnets are composed entirely of wrought iron, each being forged in a single piece and set deeply into the base, insuring ample magnetic contact, together with great solidity of construction.

The space for wire on the magnets is perfectly cylindrical, thereby insuring smooth and perfect winding of the wire, and is short in length, permitting the shaft of the machine to be low enough to free it from vibration. By this construction, the neutrality or freedom of the base from magnetism is secured, and there is no tendency to leakage, making the machine superior in this respect to those in which the base is made to serve as one of the pole-pieces.

The armatures contain several improvements. They are sufficiently large in diameter to obtain slow speed, and are so designed that the wire winding is entirely embedded below the surface of

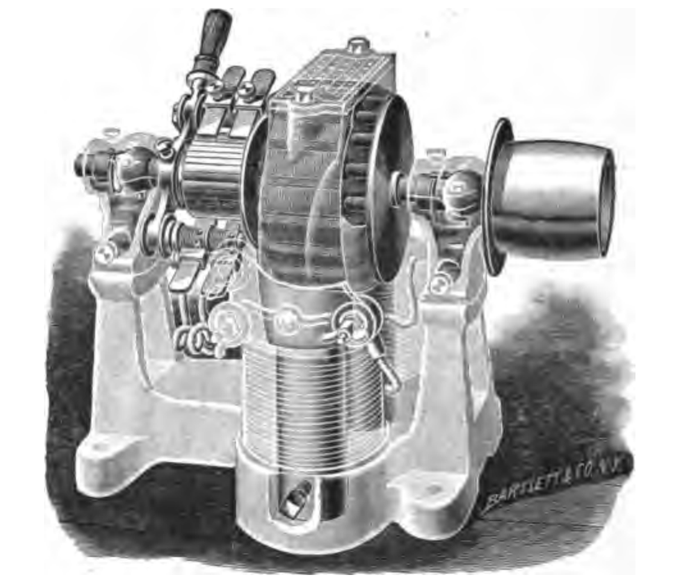

FIG. 1.

the iron core, thus protecting it from injury, holding it rigidly in position, and rendering it possible for the magnets to approach very closely to the core, so that an intense magnetic effect is pro-

Publications received at Editor's Office, March 9–28.

ARKANSAS, Annual Report of the Geological Survey of, for 1889. Vol. II. The Geology of Crowley's Ridge, by R. Ellsworth Call. Little Rock, Woodruff Pr. Co. 283 p. 8°.

CULIN. S. Chinese Games with Dice. Philadelphia, The Author. 1889. 21 p. 8°.

—— The I'Hing or "Patriotic Rising." Chinese Secret Societies in the U. S. Customs of the Chinese in America. Philadelphia, The Author, 22 p. 8°.

GRIBAYÉDOFF, V. The French Invasion of Ireland in '98. New York, Truth Seeker Co. 192 p. 12°. $1 50.

HAGERUP, A. T. The Birds of Greenland. Tr. by F. B. Arngrimson. Boston, Little, Brown, & Co., 62 p. 8°. $1.

HANS ANDERSEN's Stories. Newly translated. Part I. (Riverside Literature Series. No. 49.) Boston and New York, Houghton, Mifflin, & Co. 96 p. 16°. 15 cents.

HATCH, F. H. An Introduction to the Study of Petrology: The Igneous Rocks. London, Swan Sonnenschein & Co.; New York, Macmillan. 128 p. 12°. 90 cents.

HÖFFDING, H. Outlines of Psychology. Tr. by Mary E. Lowndes. London and New York, Macmillan. 365 p. 12°. $1.50.

LUDLOW, H. H., and BASS, E. W. Elements of Trigonometry. 3d ed. New York, Wiley. 294 p. 8°. $3.

NATIONAL Guard, The. Vol. I. No. 1. *w.* Washington, J. H. Polkinhorn. 16 p. f°. $3 per year.

SLOANE, T. O'C. Rubber Hand Stamps and the Manipulation of Rubber. New York, N. W. Henley & Co. 146 p. 12°. $1.

TRUTH SEEKER Annual and Freethinkers' Almanac, The, 1891. No. 1, January. *m.* New York, Truth Seeker Co. 114 p. 8°. $3 per year.

duced. The armature is mounted upon a brass face-plate, which is first turned perfectly true, and after completion the armature is carefully balanced, so that when run at full speed the motion is hardly perceptible. The bearings are all of the self-oiling type,

FIG. 2.

which do not require attention oftener than once in two to four weeks.

In the regulator, the arrangement of contacts in the switch on top is such that both the field and armature of the motor are charged by the single operation of turning the knob, making it impossible to put the current on the armature before the field is charged, which has often been the cause of the burning-out of motors by the use of ordinary regulators. The field is first charged through a small resistance-coil, which is put in for the purpose of preventing a too sudden change in the magnetic strength of the latter, as well as to divide the spark when the motor is disconnected. The coils used for starting the armature are all of the

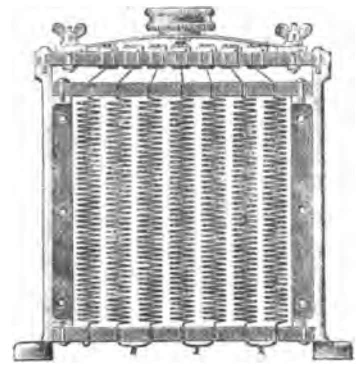

FIG. 3.

same size wire, carefully tried for carrying the full current of the machine at all speeds. With the fire-proof regulator, the motor can therefore be slowed down and left running at any desired speed indefinitely; and the usual caution, "never to leave the box half turned on for fear of overheating and fire," is unnecessary. The capacity of these boxes is stamped upon them also, as it is on all apparatus made by the company.

SCIENCE

[Entered at the Post-Office of New York, N.Y., as Second-Class Matter.]

NINTH YEAR.
VOL. XVII. No. 427.

NEW YORK, APRIL 10, 1891.

[redacted]PIES, TEN CENTS.
$[redacted] ADVANCE.

PROTECTION FROM LIGHTNING.

PROSPECTUS.

47 LAFAYETTE PLACE, NEW YORK, March 9, 1891.

It is proposed by the owners of letters patent dated Dec. 16, 1890, on an improved method for protecting buildings from lightning, etc., to organize a company for the handling of said patent and all improvements; and subscriptions are requested on the following terms and conditions:—

1. A company is to be organized with a capitalization of $10,000, in 1,000 shares of $10 each, fully paid in at par, the company to be organized in such State as the subscribers may determine by vote when all shares have been subscribed for, and with a charter to contain a provision that the amount of capitalization shall never be increased.

2. This $10,000 is to be used as working capital; and the object of the company will simply be to place licenses with responsible persons, corporations, or sub-companies, at such rates of royalty as may be agreed upon by a majority vote.

3. In lieu of any stock or cash payment to the inventor for his patent, the inventor will give said company the exclusive control of his said inventions in consideration of the payment to him by said company of one-third of the gross royalty receipts.

The officers of the company shall be elected by a majority vote of the stockholders without reserve. No stock shall be given to anybody for services or any thing else except actual cash payment at par into the treasury.

No subscriptions will be binding until the full number of 1,000 shares has been subscribed for.

Subscriptions are solicited in amounts from five shares upwards. The list opens with subscriptions for **one hundred and five** shares.

N. D. C. HODGES.

BUSINESS OPPORTUNITY.

There is a good chance for the right man as Manager of the

LIGHTNING PROTECTION COMPANY,

which is being formed to operate under broad patents. The new method will certainly revolutionize the whole system of protecting property from lightning.

Local companies are already forming to operate under licenses from the parent company, and we should be glad to hear from any who would care to consider entering this new field.

Correspondence is solicited with those desiring further information.

N. D. C. HODGES, 47 Lafayette Pl., N.Y.

CALENDAR OF SOCIETIES.

Biological Society, Washington.

April 4.—T. H. Bean, Kennerley's Salmon; Theobald Smith, Remarks on Recent Bacteriological Progress in the Prevention and Cure of Disease; V. A. Moore, Production of Immunity in Guinea-Pigs, with Sterilized Cultures of Hog-Cholera Bacillus; Theodore Gill, On the Classification of the Apodal Fishes; E. M. Hasbrouck, A Monograph of the Carolina Parrakeet.

Appalachian Mountain Club, Boston.

April 8.— Warren Upham, A Classification of Mountain Ranges according to their Structure, Origin, and Age; C. G. Van Brunt, A Trip to Mount Adams and the Club-Hut in a Mid-Winter Storm (illustrated by the stereopticon).

A special meeting will be held Thursday, April 30, at 7.45 P.M., at which Mr. Emil Huber of Zürich, Switzerland, a member of the Swiss Alpine Club, will give an illustrated lecture on the Alpine Features of the Canadian Selkirks, and Professor C. E. Fay will give a brief account of the mountain regions visited by him last summer, and especially of a day's climbing in the Selkirks.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—All of Vol. I. of *Journal of Analytical Chemistry*, published at Easton, Penn. State price and condition. SCIENCE BOOK AGENCY, 47 Lafayette Place, New York.

WANTED—A position in a Summer School of Gymnastics to teach any one or more of the following named physical exercises, viz.: Fencing (to ladies especially), Sparring, Club Swinging, Wands, Chest Weights and Free Movements. Am prepared to offer very favorable terms to any school desiring such work. WILLIAM FINDLAY, Proprietor of Phila. Inst. of Phys. Cult., 1009 Arch Street, Philadelphia, Pa.

A COLLEGE GRADUATE—has had four years' experience in analytical laboratory and in works—desires position in chemical works, oil refinery, or paint works, or in any position where a technical chemist is needed. Address "CHEMIST," care *Science*.

A HARVARD M.A., especially interested in Natural History, would like to learn of some outdoor occupation for the summer. Remuneration a secondary object. SUMMER, *Science* Office.

A CHEMIST, taking P. G. work in the Scientific Department of one of our best colleges, would like to negotiate for some industrial position, where his knowledge would be of avail. Can furnish best of references. R. S. W., Box 691, Amherst, Mass.

WANTED—A position to teach Electrical Engineering by a student from leading English and French and U. S. science schools, or would accept position as Consulting Electrical Engineer, Electrician, etc. Very highest testimonials London & Hartford Publishing Co., N. Y. (International Press Department.)

WANTED.—A young man in college would like a position during the summer of 1891 in some scientific work, particularly Orinthology, either as an instructor or tutor, or in making collections or accompanying some scientific expedition. Can give good references. Address HUBERT L. CLARK, Amherst, Mass.

WANTED.—A young man who has been teaching in a first-class High School desires a position in a similar institution. Is competent to teach Mathematics, Latin, Book-keeping, and the English branches. Can give highest references Address H. W. MARTHENS, 6208 Broad St., Pittsburgh, Pa.

WANTED.—A situation in a scientific house by a graduate of the scientific department of the Jersey City High School as Geologist, Mineralogist or as assistant teacher in Physics or assistant to a chemist. Best of references. E. W. PERRY, 582 Third Street, Jersey City, N. J.

WANTED.—By a medical student of three courses, a position on some war or mercantile vessel sailing between America and some foreign country, as Clerk, Assistant Physician or Druggist, or any respectable occupation. Content with a moderate remuneration. Highest commendations. W. L. S., *Science* Office.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

Will exchange a new Thomson reflecting astatic galvanometer, about 6,000 ohms, made by Clark, Muirhead & Co., London, and costing £30, with 1-9, 1-99, 1-999, shunts, lamp and scale, for a Weston voltmeter and ammeter, or arge Wheatstone bridge, dial pattern, or a portable testing outfit. Address G. A., *Science* Office, 47 Lafayette Place, New York.

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

I have a good supply of Eastern Coleoptera which I wish to exchange for species not in my collection. Melandryidae and Oedemeridae especially desired. Joe C. Thompson, Rosebank P. O., Box 73, S. I.

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1890 Seeger and Guernsey Cyclopedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost $6. David R. Lewis, Saybrook, Ill.

SCIENCE

NEW YORK, APRIL 10, 1891.

MALARIA AND THE CAUSATION OF INTERMITTENT FEVER.[1]

DR. TOMMASI-CRUDELI and others have claimed that intermittent fever is caused by a bacillus.

Drs. Laveran, Osler, Council, and others have proved, to their own satisfaction at least, that intermittent fever is caused by a microscopic hæmatozoön.

At the meeting of the American Medical Association in Cincinnati, in May, 1888, I presented what I then considered, and still consider, to be incontrovertible evidence that intermittent fever is caused by exposure to changes of atmospheric temperature; that ordinarily its causation is quantitatively related to, and apparently controlled by, the range of atmospheric temperature.[2] It seems to me that both these lines of evidence, which appear to be so divergent, may be true. I feel sure that my own line is; and I have very great confidence in those who have presented the other line of evidence in which they are expert.

Therefore, although those who have held the germ theory of the causation of intermittent fever have not, so far as I know, accepted the evidence which I have collected and published, yet I feel impelled to again ask attention to it. I attempt this the more readily, because the facts and considerations, which it seems to me to make it appear possible that both lines of evidence may be true, were, in the main, held in mind when I read my paper two years ago; but there was not then time to elaborate, and I therefore only referred to, but did not fully state them.

I suppose that all here are probably familiar with the literature of the subject of the bacillus of malaria, and also that relative to the hæmatozoön of malaria, discovered by Laveran. I may therefore devote my time exclusively to that other phase of the subject on which I have collected evidence, and which is probably little known.

The most important evidence which has been presented by myself is as follows: —

1. Statistics of sickness from intermittent fever in Michigan during a long series of years, arranged to show the relation of intermittent fever to changes in atmospheric conditions, and which have proved to my mind that the controlling condition is associated with atmospheric temperature, the sickness rising and falling with the temperature.

2. Statistics relative to intermittent fever in the United States armies, elaborated from the medical and surgical history of the war of 1861–65.

An abstract of a summary of conclusions, based upon the evidence which I collected, is as follows : —

"2. The controlling cause of intermittent fever is exposure to insidious changes, or changes to which one is unaccustomed, in the atmospheric temperature.

"3. In the mechanism of the causation of intermittent fever, the chief factor is the delay in re-action from exposure to cool air. This delay, extending to a time when greater heat-loss should occur, results in the abnormal accumulation of heat in the interior of the body, and in disturbed nervous action,— the chill; and the final re-action is excessive, because of the accumulation of heat, and sometimes because it occurs at the warmest part of the day.

"4. The fever is the excessive re-action from the insidious influence of the exposure to cool air; and it is periodical because of the periodicity of nervous action, and, because the exposure and the consequent chill are periodical, owing to the nightly absence of the warmth from the sun.

"5. Residence in valleys or low lands through which or upon which cold air flows at night, and thus causes insidious changes in the atmospheric temperature, favors intermittent fever.

"6 In our climate, those measures, such as drainage, which enable the soil to retain warmth during the night, and thus reduce the daily range of temperature immediately over such soil, tend to decrease intermittent fever among residents thereon.

"7. In the cure and prophylaxis of intermittent fever, those remedies are useful which lessen torpidity and tend to increase the power of the body to re-act promptly to insidious changes in atmospheric temperature."

Preparing, now, to forge a link, in the chain of evidence, which was omitted from my paper, Sir William Moore, who has had great experience and observation in India, says, "So-called malarious fevers are caused by sudden abstraction of heat, or chill, under the influence of cold, and more especially of damp cold. These effects of chill are more marked in hot climates, because of the antecedent exposure to great solar heat, the anæmia and skin debility resulting from heat and the disregard of suitable precautions."

I think that my statistics indicate that another reason for there being most intermittent fever in hot climates is because the difference between the day and the night temperatures is the greatest in hot climates, and consequently the demands upon and resulting disturbances of the heat-regulating apparatus of the body are greatest in hot climates.

Intermittent fever is most prevalent in hot climates. In temperate climates, intermittent fever is most prevalent in the warm months. Here a reason similar to that just given applies,— it is then that there is greatest difference between the day and the night temperatures

I believe that perspiration is probably a factor in the causation of intermittent fever. I do not base this opinion merely upon the facts just stated, relative to place and time of greatest prevalence, but mainly upon two facts, as follows: perspiration tends to cause chill, because of the fact that evaporation from moist clothing tends to lower the temperature rapidly. I believe that a chill, especially at the warmest time of the day, is not infrequently sufficient to start the disease intermittent fever. Excessive perspiration tends to change the condition of the blood; and chill tends to change the condition of the blood in some such way as follows: when the surface of the body is strongly contracted, the blood is driven from all the surfaces; the circulation is impeded; the blood parts with some of its fluid, and with it the salts, which pass into the urine; then there comes a demand of the tissues for blood; thirst is great, which, when satisfied, again fills up the blood-vessels. This rapid changing of the proportion of fluid in the blood tends, I believe, toward the solution or breaking-up of the red-blood corpuscles My belief is that the destruction of the red corpuscles is greater than it would be if only the proportion of water in the blood was changed; that the destruction occurs partly through a disturbance of the proportion of certain salts in the blood. It is not difficult to see how this may be. Excessive perspiration takes out salts, especially sodium chloride, in considerable quantity; the urine passes out salts in considerable quantity. On the other hand, the water drank to quench the thirst does not ordinarily take salts into the blood, except in cases where common salt is given as a remedy, which is sometimes done by non-professional persons. According to experiments made many years ago, in the circulating blood, in health, the red corpuscles are preserved by sodium chloride from being dissolved in the albumen. As this paper is not an exhaustive treatise on this sub-

[1] Abstract of a paper read at the forty-first annual meeting of the American Medical Association at Nashville, Tenn, May, 1890, by Henry B. Baker, M.D., of Lansing, Mich.

[2] "Malaria and the Causation of Periodic Fever" (Journal of the American Medica' Association, Nov. 10, 1888).

ject, but is intended to be suggestive to other investigators. I do not now attempt to collate recent evidence on the changes in the blood. In order, however, to account for the destruction of the red corpuscles, the formation of the pigment, and for the phenomena of intermittent fever, I see no need for the micro-organism which is alleged to be parasitic in the blood, in intermittent fever. It seems to me that all of the phenomena can be accounted for about as well without the parasites as with; but it seems to be a general fact in nature, that, whenever a highly organized being commences to break down, there are generally organisms that await the occurrence; and, when the breaking-down process is of elements microscopic in size, I believe that micro-organisms are generally there. I accept the evidence of the eminent men who have reported that they are present in the blood in intermittent fever.

But if we grant that malarial fever is caused by micro-organisms parasitic in the blood, it has remained to be explained how it is that the micro organisms only cause intermittent fever under certain conditions of the atmosphere. That intermittent fever does occur under some conditions, and does not occur under other conditions, has long been positively known. I claim that the statistics which I have collected prove what those conditions are, and that the relation of those conditions to intermittent fever is quantitative and causal. I refer more especially to the evidence relative to the half million and more cases of intermittent fever which occurred in the United States armies during the war in 1862–64, and to the evidence of the recorded experience of physicians in Michigan during eight years.[1]

[1] Diagrams and statistics were given by Dr. Baker in support of his position.

HEALTH MATTERS.

Ether-Drinking.

MR. ERNEST HART, editor of the *British Medical Journal*, has lately published some statistics and important information relative to the above subject. The matter is of very great value, directly and indirectly, says Henry Conkling, M.D., in *The Brooklyn Medical Journal* for April. It calls attention to the internal use of a remedy which, as a powerful cardiac stimulant, has been used but little of late. The published statistics have been collected, in part personally, and also by communication with medical men, clergymen, and others in the various parts of Ireland where the custom prevails.

The earliest history of the habit goes back to 1842 The greatest amount of ether used for drinking-purposes was in 1876. A few years after this date there was a diminution in the consumption; but it has since increased, until at the present time the amount nearly equals that of 1876. The majority of the ether (methylated ether) comes from large English houses, being sent sometimes to wholesale Irish firms, who retail it, or directly to the smaller dealers. It is put up in stoppered bottles or metal vessels. It is sold to the consumers in groceries, taverns, and public-houses, selling for two cents (United States money) for two drams. Its very small cost enables the dose to be frequently repeated. From two drams to half an ounce is the amount usually drunk; and this is repeated from two to six times during the day, depending on the personal habits. One or two cases of confirmed drinkers are mentioned where one pint of ether was generally used, when on a debauch, in divided doses.

The amount that produces intoxication depends on the individual. The ether is drunk in a single swallow, sometimes diluted, and again taken pure. The intoxicating effects are quickly produced, and quickly pass away. It is possible, therefore, as the author observes, for an *habitué* to become intoxicated many times in a short period.

A small dose causes a feeling of exhilaration, the drinker laughing, dancing, and being quite wild in his movements. If the small dose be not exceeded, there is no period of marked depression following the stimulation; but in larger quantities a state of stupor is frequently present, and, as the effect passes away, a feeling of weakness is left.

It will be seen, in reading the individual accounts given in the paper, that mania is a marked feature very commonly presented, the drinkers often becoming very violent.

In moderate amounts, no lesions anatomical in their nature are produced. Of the two intoxicants alcohol and ether, the former probably causes more bodily derangement.

In ether-drinkers who have continuously consumed large quantities, a train of nervous and circulatory disturbances is generally present. Emaciation has been observed in certain cases, and occasionally the skin is of a cyanotic hue. The more moderate drinkers generally suffer from various forms of stomach troubles. In all cases there has been observed a marked change, in the way of deterioration, in the moral character.

The relation of ether to insanity was also investigated. No satisfactory evidence of the drug being directly causative could be gathered, but physicians to certain of the insane-asylums regarded it as detrimental in all cases where there was latent insanity. Death is probably not hastened in any great degree, although, by interfering with nutrition, the general health may become impaired.

Attention is called to the fact that there is danger to the user from having the drug near the fire or lights of any kind. The author believes that the practice probably prevails in certain parts of large cities.

It is interesting to observe how common the use of ether as an intoxicant must be, in the districts investigated, when the public conveyances are frequently impregnated with its odor.

This curious and novel paper teaches one valuable therapeutic lesson: the effect of the drug has been shown to be rapid and transient. In its use, therefore, as a cardiac stimulant, this point should be recollected, and no long intervals should go between the time of giving the various doses. Its rapid action makes ether a safe and valuable remedy for hypodermic use in conditions of syncope.

Poisonous Mussels.

A case of fatal poisoning of a mother and four children from poisonous mussels is reported by Sir Charles A. Cameron, M.D., in the *British Medical Journal* for July 19, 1890, and republished in *The Brooklyn Medical Journal* for April.

The first symptoms came on in twenty minutes after eating the stewed mussels. These were a prickly ("pins and needles") pain in the hands. Five persons ate of the dish, one lightly; and in one hour afterward one of the children died, and an hour later the mother and three other children. One child and the servant recovered.

The chief symptoms were vomiting, dyspnœa, swelling of the face, loss of co ordination of movements, and convulsions. The patients died asphyxiated. The mussels were fresh, and were obtained from a pond which was a mixed salt and fresh water pond, and received some sewage. The mussels, on examination, were found to have large livers and brittle shells. A leucomaine was extracted from the liver of the mussels which resembles Brieger's mytilotoxine ($C_6H_5NO_2$). The liver seemed to be the seat of the poison, which had been before noticed by M. Dutertre of France. The cause of this peculiar disease, the author thinks, is due to the foul water in which the mussels lived.

The livers of these mussels were examined microscopically by Dr. McWeeney, and in a preliminary note published in the *British Medical Journal* of Sept. 13 he describes at least five different organisms appearing in his cultures, one of which, he thinks, is the specific organism of the poison.

The important lesson is, that mussels from stagnant or sewage-laden waters should not be eaten.

Influenza in the German Army.

The medical department of the Prussian War Office has furnished statistics of the epidemic of influenza from the medical records of the German Army, an extract from which is given in *The Boston Medical and Surgical Journal* for March 26. The name "grippe" is supposed to be derived from the Polish word "chrypka," which means catarrh. The epidemic appeared in the army suddenly at the end of November, 1889, and in March was

considered as entirely passed. The first cases occurred in the barracks situated in the Baltic provinces, from which place it spread rapidly, the larger garrisons being generally attacked first. There was, roughly speaking, a belt stretching across the country from north-east to south west, in which belt the epidemic seemed to travel, and outside of which the cases were less frequent and severe. A number of garrisons at a distance from this path, that is, in the south-east and north-west, escaped altogether. The time occupied in spreading through the whole army was five weeks, whereas the epidemic of the year 1833 took more than three months. The total number of cases reported was 55,263, of which three-tenths of one per cent were seriously ill, and one-tenth of one per cent died. The Bavarian troops suffered the most. The larger number of cases occurred among the younger men, and the smallest number among the artisans. Many other interesting data are recorded.

Hæmolymph Glands.

It might be thought, that, after the careful search that has been made in all the tissues of the animal body, it would be almost impossible to find a structure that has up to the present remained undescribed; yet Mr. W. F. Robertson, working under Dr. William Russell, in giving a careful histological description of his so-called hæmolymph glands, has opened up a new field for histological and pathological research. From the description given, says the *Lancet*, the hæmolymph glands appear to be a kind of cross between the spleen and the lymphatic glands, as almost all the structures that Mr. Robertson describes may be found in one or other of these organs, although they have never yet been figured as he finds them arranged. Most observers who have noted the existence of the small prevertebral blood-red points have assumed that they were simply lymphatic glands, the cortical spaces of which were distended with blood; and, although every butcher can point them out, it appears that no one has hitherto had sufficient curiosity to determine him to examine these structures microscopically. The large cells, with their colorless subdivided nuclei found in the sinuses, appear to be somewhat similar in character to the large red-blood corpuscle-forming cells that have been described in the spleen, and even free in the blood circulation, and it will be interesting to note whether it is possible to make out any relation between the cells in the blood and those in the hæmolymph glands. Although at first sight it might appear that Mr. Robertson's observations may lead to further complications in the study of the blood-forming and blood-destroying functions, it is hoped that a careful study of the structures that he has so well described may allow of further light being thrown on these subjects. We are gradually drifting further and further away from the idea that special functions are necessarily bound up in special organs. That there is a special development in certain kinds of tissue in special organs, and consequently that certain functions are here carried on more actively, all will admit; but we are gradually coming to see that such functions as the glycogenic, hæmogenic, and the zymogenic are carried on in every part of the body, and that the various differences as regards these functions in the various tissues are those of degree rather than those of kind.

Dietetic Employment of Fat.

W. Zuntz has a paper on the dietetic employment of fat in the *Therapeutische Monatshefte*, October, 1890, an abstract of which appears in the *Medical and Surgical Reporter*. He was induced to put to the experimental test of some conditions of digestion of fat a preparation of chocolate suggested by Von Mering. The chocolate is so made that it possesses a sufficient quantity of free fatty acids to form a permanent emulsion without in any way injuring the taste of the chocolate. In order to find out whether the digestibility of fat is enhanced by the power to form an emulsion Zuntz sought to find out what quantity of cacao-butter, with and without the addition of fatty acids, was appropriated when administered to dogs. The result was, that there was an increase in digestibility, which was only slight,— two per thousand of the fat,— if moderate quantities of cacao butter were cooked with the rest of the food, but it was considerable if (as is usually the case with cod-liver oil, in order to avoid stomach digestion) the cacao-butter was given some time before the rest of the food, and in somewhat greater quantities. In the latter case there appeared in the stool 9.9 per cent of pure cacao-butter, and only 6.1 per cent of the emulsionized.

Corresponding to the result of the emulsionizable cacao-butter in dogs, the fat of Mering's chocolate proved to be very digestible in men. For three days a moderate diet poor in fat, consisting of bread and lean meat, was given, and in addition a daily quantity of 416 grams of chocolate containing 87 grams of fat. In the fæces appeared only 4.88 per cent of fat; whereas Weigmann, in a series of experiments with ordinary cacao-butter, administering 53 grams, recovered 5.5 per cent. In comparison with the most used fats, and those fats prized on account of their being easily digestible, such as butter, lard, marrow, the fat of the chocolate preparation is seen to be considerably superior.

Eating before Sleeping.

A recent writer, says the *Journal of the American Medical Association*, states that the view that brain workers should go supperless to bed is not good advice. Most medical authorities of the day think it wrong It is a fruitful source of insomnia and neurasthenia (sleeplessness and nervous prostration). The brain becomes exhausted by its evening work, and demands rest and refreshment of its wasted tissues, not by indigestible salads and "fried abominations," but by some nutritious, easily digested and assimilated articles. A bowl of stale bread and milk, of rice, or some other farinaceous food, with milk or hot soup, would be more to the purpose. Any of these would insure a sound night's sleep, from which the man would awaken refreshed.

New Medicinal Soaps.

The *Edinburgh Medical Journal*, February, 1891, says that Eichhoff of Elberfield, who has already added to the list of medicinal soaps some of real value, and embodying some valuable improvements, has continued his researches into the subject. He reviews the conditions of the skin in which soap treatment is to be recommended. This is specially indicated in cases where the skin is unctuous. The soap removes the excess of fat, while the incorporated drug, if suitably chosen, acts at the same time on the disease itself, and, as Eichhoff thinks, can chase the offending organisms from the ducts of the cutaneous glands. He quotes in support of this the treatment by medicinal soaps of psoriasis, which he regards as parasitic, and of acne, the pustules in which are now believed to be due to the pyogenic micrococci. He praises also the cleanliness, the innocuousness, and the cheapness of this method with the vigor of a true partisan.

Soaps may be, for convenience, divided into (1) alkaline, containing an excess of free alkali; (2) neutral, in which all the alkali is combined with the fatty acids; (3) so-called acid soaps, which are prepared either by the addition of weak acids or by being superfatted, and eventually re-act faintly acid. The alkaline may be used to remove masses of scales; while in acute inflammations of the skin, or when it is irritable, the neutral or superfatted soaps are to be employed. The superfatting of the new soaps consists of 2 per cent lanoline, and 3 per cent olive oil, and they are made by Ferdinand Mühlens at Cologne. Among these new soaps may be specially mentioned a menthol soap, containing 5 per cent of menthol. The local anæsthetic influence of menthol on the skin is well known, and the principal use of this soap will probably be found in lessening pruritus. Eichhoff cites some cases where cure resulted in pruritus senilis and pruritus genitalium. He recommends, that, should the soap be employed for the head or lace, the eyes should be kept firmly shut, else an unpleasant, though, he says, not dangerous, coldness of the conjunctiva is perceived. A 5-per-cent salol soap is one which may prove useful in psoriasis. The salol, when so used with water, breaks up into carbolic and salicylic acids, and these in their nascent condition may be expected to act with energy. A 5-per-cent resorcin soap promises to be of advantage in cases where this valuable drug is indicated.

NOTES AND NEWS.

THE excursion committee of the Appalachian Mountain Club, Boston, presents the following preliminary programme for the 1891 excursions, subject to possible changes: Saturday, April 18, mayflower walk, Marshfield; May 9, May walk, Andover, Mass.; May 30, Mount Wachusett; June 17, laurel excursion to either Milford or Mount Vernon, N.H.; about July 1, field meeting at the Catskill Mountains, N.Y.; Monday, Sept. 7 (Labor Day), Bristol, N.H. It is hoped that a camping party to Moosehead Lake may be arranged in August. Members who desire to join the party are requested to notify the chairman of the special committee before July 25. The autumn excursion may possibly be to Mount Chocorua the latter part of September.

— Bulletin No. 72 of the Michigan Agricultural Experiment Station is by W. J. Beal, and is entitled "Six Worst Weeds." Mr. Beal states that some of our most troublesome weeds are natives of the neighborhoods in which they are found, but most of them have been introduced from other portions of our own country or from foreign countries. The seeds of most weeds find their way on to a farm nicely mixed with seeds of grasses, grains, and clovers, which are drilled in or sowed broadcast on fertile soil, where they are afforded an excellent opportunity to grow and multiply. In some instances weeds are introduced as a part of the packing or straw employed to protect castings, marble, crockery, or fruit-trees. Such foreign packing should always be burned at once. By these processes above noticed, the older the country, the more troublesome weeds it will have, as every new intruder usually comes to stay. In most cases a weed becomes well established before it is discovered; and the inquiry comes, "What is it, and how can I get rid of it?" Enclosed in the bulletin were samples of seeds of six sorts which have a bad reputation, and it will be best to watch them. Most of them are already pretty well known by some of our farmers. They are not indigenous, but have all been introduced from Europe. The following rules are worth observing: 1. Carefully examine seeds before sowing, and see that they are clean, and thus prevent the introduction of weeds; 2. Keep a sharp lookout and exterminate the few first intruders before they spread themselves; 3. Usually, as in all the six cases referred to, perhaps excepting the Canada thistle, one or more so-called hoed crops, like corn, potatoes, or beans, most thoroughly tended throughout a single growing season, or for two seasons in succession, will be a good practice. There is no royal way in which to kill weeds.

— To find a paint of lasting qualities, which will prevent the corrosion of iron due to atmospheric agencies, is a problem with which engineers have dealt earnestly for many years. Until within quite recent years, little has been known in this country of the valuable properties of asphalt, and to many they are still unknown. In the popular mind it is often confused with certain coal-tar products, which, though similar in appearance, differ essentially from asphalt in character. Asphalt oils are of a non-volatile nature, and are therefore permanent, while, on the other hand, coal-tar and linseed oils are volatile, and therefore non-permanent. Herein lies the secret of the paint problem, says *The Railroad and Engineering Journal* for April. In order to prevent rust, some substance must be used as a coating for the iron which is impervious to air and moisture; and it is of equal importance, that it may remain impervious, that it should be unaffected by the heat of the sun and by exposure to the air. It is claimed that there is no other substance in nature which so nearly complies with these severe requirements as asphalt. The so-called asphalt paints which have been commonly used in the past are such only in name. They contain, at best, but a very small per cent of asphalt, which is incorporated in the form of a pigment, and which serves no valuable purpose. Asphalt, on the contrary, should be the main constituent, since the virtue of such a paint depends upon the presence of the permanent asphalt oils. When these so-called asphalt paints are made in light colors, durability becomes subservient to ornamentation. The virtues sought in asphalt are lost by substituting for it the necessarily large quantity of light-colored pigment essential in counteracting the natural dark color of the asphalt.

— The question of the use of special fertilizers under glass is becoming one of great importance, and is attracting much attention among practical gardeners and scientific men. Even the best and most skilled gardeners sometimes find that their soil, made up after the best formulas, fails to give the results expected. The plant-food seems to be unavailable, or the plant lacks the vigor to make use of it, and something more active is needed to give it a start. To determine what special fertilizers will give the best results applied to crops under glass, a series of experiments were started in the winter of 1888–89, at the Massachusetts Agricultural College, under the direction of Samuel T. Maynard of the Division of Horticulture, the results of which are deemed of sufficient value for publication, although a longer series of tests may somewhat modify the results thus far obtained. In it was found, that, of the nitrates, the nitrate of potash gave the best results, but that the sulphate of ammonia gave better results than either, especially in the production of a foliage crop Of the potash salts, the sulphates gave better results than the muriate. Bone-black showed a marked effect in increasing the number of blossoms.

— The director of the Connecticut Agricultural Experiment Station, New Haven, Conn , calls the attention of dairymen to a method of determining fat in milk devised by Dr. Babcock of the Wisconsin Station. Its merits are, that it is rapid; that both the milk and the fat are measured, so that all weighing is dispensed with; and that it is very accurate. It furnishes, he thinks, the most rapid and accurate means of testing milk of individual cows or herds. The apparatus is in daily use at the station. Twenty-three cows are under experiment, and separate fat determinations are made daily in the morning and night milk of each cow; the whole, including the cleaning of the apparatus, being accomplished in two hours by two persons. A considerable saving of time will be secured when power is used for driving the centrifuge. With this aid, a young man or woman could probably do the whole easily in from three to four hours.

— A correspondent of the *Pall Mall Gazette* writes, "I recently witnessed the following little incident on the Thames, near Twickenham, when the river was full of land-water, and therefore very swift and dangerous. Two dogs — one a large animal, the other a little terrier — were enjoying a swim near the bank, but soon the little one was carried out some distance, and was unable to get to shore. By this time the big dog had regained the shore, and, seeing what was happening to his companion, be gan running backwards and forwards in the most excited manner, at the same time whimpering and barking, and evidently not knowing for the moment what to do. The terrier was fast losing strength, and, although swimming hard, was being rapidly carried down stream. The big dog could contain himself no longer. Running some yards ahead of his struggling friend, he plunged into the water and swam vigorously straight out until he got in a line with the little head just appearing behind him. Then he allowed himself to be carried down, tail first, until he got next to the terrier, this being accomplished in the cleverest manner, and began to swim hard, gradually pushing the little one nearer and nearer to the shore, which was gained after a most exciting time. The fact of this canine hero going so far ahead to allow for the strong current, and the judgment shown in getting alongside, and then the pushing, certainly seemed to me to betoken instinct of a very high order "

— An important communication upon the color and absorption spectrum of liquefied oxygen is made by M. Olszewski to a German periodical, and a brief abstract is published in *Nature* of March 26. Liquid oxygen has hitherto been described as a colorless liquid. In thin layers it certainly appears to be colorless; but M. Olszewski, in the course of his investigation of the absorption spectrum, has obtained a sufficient quantity of the liquid to form a layer thirty millimetres thick, and makes the somewhat unexpected and very important discovery that it possesses a bright blue color resembling that of the sky. Great precautions were taken to insure the purity of the oxygen employed, the absence of ozone, which in the liquid state possesses a deep-blue color, being especially ascertained. Carbon dioxide, chlorine, and water-vapor

were also completely eliminated, the oxygen having been left in contact under pressure with solid caustic potash for a week. In view of this fact, that oxygen in the liquid state transmits a preponderating quantity of blue light, M. Olszewski's latest experiments upon its absorption spectrum are specially interesting. In a former paper to the *Monatshefte*, an account of which was given in *Nature*, the absorption spectrum of a layer 7 millimetres thick was shown to exhibit two strong dark bands,— one in the orange, extending from wave-length 634 to wave-length 622, distinguished for its breadth; and one in the yellow, wave-length 581–573, distinguished for its intensity. When the thickness of the layer was increased to 12 millimetres, two further bands appeared, — a very faint one in the green, about wave-length 535, and a somewhat stronger one in the blue, extending between wave-lengths 481 and 478. M. Olszewski now finds that his layer 30 millimetres thick, which possesses the blue color, exhibits a fifth band in the red, corresponding with Fraunhofer's A. This band is rendered still more apparent when a plate of red glass is held between the source of light and the slit of the spectroscope. It is stronger in intensity than the band of wave-length 535, but fainter than the other three bands. This observation of the coincidence of an oxygen band with the telluric band A of the solar spectrum is of considerable interest: for Angström, in 1864 expressed the opinion that this band A was not due to the aqueous vapor of the atmosphere; and Egoroff and Janssen, who examined the spectrum of long layers of compressed gaseous oxygen, were of opinion that it was due to oxygen. In conclusion, M. Olszewski remarks that the color exhibited by his 30-millimetre layer is exactly what one would expect from the nature of its absorption spectrum. He also suggests that the blue color of the sky may be simply due to the atmospheric oxygen, which in gaseous layers of such extent may exhibit the same color as when compressed into a few centimetres of liquid. Apart from the discussion of this debatable subject, the fact is certainly of interest to chemists, that ordinary oxygen and its condensation allotrope ozone, when compressed into the liquid state, are thus related as regards color, the former possessing a bright blue and the latter a deep blue tint.

— Professor Elihu Thomson, according to *Engineering* of March 27, has recently completed some very remarkable experiments on the physiological effects of alternate currents. He finds that the danger of the current diminishes as the number of alternations per second is increased. Thus it took twenty times as strong a current to kill a dog when the alternations were 4,500 per second as when they were 120 per second. When the alternations were 300 per second, the current was only half as dangerous to life as when the alternations were 120.

— Traffic in the Suez Canal continues to expand, and now the gross tonnage of vessels using it is about ten millions, and it is interesting to note that Britain continues to own a preponderating proportion of that tonnage. Last year, according to *Engineering*, 3,389 vessels traversed the canal, and, curiously enough, the numbers were practically equally divided between outward and homeward vessels. At the Port Said entrance 1,694 vessels passed in, while 1,695 entered the canal at Suez. This total has thrice been exceeded. In 1885 the maximum was reached at 3,624 vessels, and has not been equalled; while in 1888 the number was 3,440, and in 1889, 3,425 vessels. The tonnage, however, shows a steady expansion. It is well known that the average size of English sea-going steamers is increasing, and this is satisfactory for the canal authorities. It does not affect the dues paid for transit, and admits of a larger tonnage passing within a given time. It is found, for instance, that while the number of vessels passing in 1885 was 240 more than in the past year, the tonnage now is nearly half a million greater: in other words, the average size of vessels in 1885 was about 1,750 tons, and it is now over 2,000 tons. The transit receipts show clearly the growing popularity of the canal route to the East. In 1869, the first year of the canal, the receipts totalled only £2,076; in the year following they were £200,000; in 1872 they reached £656,300, and five years later this sum was more than doubled. Between 1880 and 1882 there was a great forward movement, the total being increased to £2,421,832. Since then the progress has been neither so steady nor so great But during the past three years the upward movement has continued, the total last year being £2,680,436. Of the total tonnage, Britain owns nearly 78 per cent. There has been a great development in the number of vessels using the canal at night, and navigating by the electric light. Of the total number passing through the canal last year, 2,836 went at night, or 48 per cent. The number per month varied from 276 in December last, to 209 in August. In 1887 the night passages were 395, or 12.6 per cent of the total; in 1888, 1,611, or 47 per cent; in 1889, 2,445, or 71.5 per cent. According to Consul Burrell, from whose report to the foreign office these figures have been taken, the average time of transit has been reduced to 24 hours 6 minutes, against 25 hours 50 minutes in 1889, 31 hours 15 minutes in 1888, and 36 hours in 1886. By night with electricity the passage takes a shorter time than by day, the average last year being 22 hours 9 minutes; in 1889, 22 hours 30 minutes; in 1890, 22 hours 34 minutes. The shortest passage last year was 14 hours 15 minutes by electric light, and the fastest on record. For the transit with electric light the great majority of the vessels obtain the apparatus from different shipping agents at a uniform rate of £10 for the transit.

— We learn from *Engineering* that in a lecture delivered before the students of Sibley College, Mr. O. Chanute, president of the American Society of Civil Engineers, dealt with the question of aërial navigation. Reasoning from the results obtained by Capt. Renard with "La France," he concludes that with a balloon 330 feet long, with a maximum diameter of 55 feet, a speed of from twenty-five to thirty miles an hour might be attained. Mr. Chanute thinks, however, that the problem of flight is more likely to be solved by means of the aëroplane than with the balloon. To obtain a speed of twenty-five miles an hour with aëroplanes, he estimates that 5.87 horse-power would be required per ton of weight. The inclination of the supporting surface should be between one degree and two degrees to the horizon. The great difficulty, Mr. Chanute states, is that of obtaining a light enough motor. The weight should not exceed fifty pounds per horse-power; and the lightest steam-engine he is acquainted with, especially built for aërial navigation, weighed thirteen pounds per horse-power. Mr. Brotherhood has obtained a horse-power with but little over one pound of weight in his three-cylindered engine used in Whitehead torpedoes. These engines work with compressed air.

— We learn from the *Journal of the Society of Arts*, London, that sawdust and shavings, practically waste substances, are turned to account by M. Calmant of Paris for the production of a finely divided vegetable charcoal, which is intended to be applied for the removal of unpleasant flavor in ordinary French wine, otherwise unsalable as wine, although suitable for distillation. The charcoal is also available as a filtering medium, especially in distilleries, where it is said to be capable of filtering forty times its volume of alcohol; whereas the vegetable charcoal of commerce, gradually becoming scarcer and dearer, and which requires grinding and often recarbonization, will only filter about three times its volume. If not already separate, the sawdust of hard and soft woods must be separated, because the former requires a heat of 700° C., whereas 500° C. suffice for carbonizing the latter. Carbonization, which lasts about an hour, is effected in fire-clay, plumbago, or cast-iron retorts, of about 600 cubic inches capacity; but previous to this process, the sawdust must be sifted, first through a coarse screen to remove splinters and extraneous matter, and then through a fine sieve, which only permits passage of the actual wood-dust with the adherent calcareous matter. The product of carbonization must again be sifted to get rid of this calcareous matter which has become detached during the process, when it will, if the operation has been carefully performed, resist the action of hydrochloric acid. Shavings of either hard or soft woods, also kept separate, must be subjected to preliminary treatment (which consists in a beating, to detach the adherent dust, and then a high degree of compression in a hydraulic or other press), when they are carbonized in the same manner as the sawdust, and then ground in a mill to reduce them to the same degree of fineness. Great care must be exercised to prevent the charcoal absorbing moisture from the atmosphere, and with this object it must be enclosed in air-tight recipients until required for use.

SCIENCE:

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THE CHEMICAL SOCIETY'S JUBILEE [1]

AT the meeting in celebration of the jubilee of the Chemical Society, held in the theatre of the London University on Tuesday, Feb. 24, 1891, the proceedings were opened by the following address from the president, Dr. W. J. Russell: —

We meet to-day to celebrate the fifty years' existence of our society, — a time, if measured by the progress which our science has made, equal to centuries of former ages, but which in years is so brief a space that we have, I am happy to say, with us to-day some of those who were present, and who took an active part in the foundation of the society; and I need hardly say with how much interest we shall listen to their reminiscences of the time and circumstances connected with the birth of our society.

I would, by way of introduction, say a few words first with regard to our society, and afterwards with regard to the state of chemistry in England when our society was founded. We boast, and I believe rightly, that our society holds the distinguished position of being the first which was formed solely for the study of chemistry. Chemistry and physics, twin sisters, had hitherto always dwelt together; and many were the societies, both in this country and abroad, devoted to their joint study and development.

In London there was the Royal Society, which had hitherto received the most important chemical papers; there was also the Society of Arts, which is a hundred and ten years, and the British Association, which is ten years, senior of our society. In Manchester the Literary and Philosophical Society had been founded and actively at work since 1781; and we admit that our neighbors at Burlington House, the Astronomical, Antiquarian, Linnean, and Geological Societies, are all our seniors. They had a distinct individuality and literature of their own, which called them into existence some forty to eighty years before the commencement of our society. Small private chemical societies, no doubt, existed: they are the natural forerunners of a large society, and become merged into it. The Chemical Section of the British Association, which is an ephemeral and peripatetic chemical society, had existed from the founding of that body. If we turn to other countries, we find that, much as our science had been cultivated on the continent, it did not until later times engross a whole society to itself; the French Chemical Society not having been formed until 1857, and the now great Berlin Chemical Society not until 1868. Our interest, however, at the moment is rather in the growth of chemistry in this country than in what occurred elsewhere.

To-day we may learn how it came about that the first chemical society was established in England. I may, however, state that the reason for our meeting depends on the official record that on Feb. 23, 1841, twenty-five gentlemen "interested in the prosecution of chemistry" met together at the Society of Arts to consider whether it be expedient to form a chemical society. Of the twenty-five who then met, I am happy to say three are present, — Sir W. Grove, Sir L. Playfair, and Mr. Heisch; and Mr. J. Cock is another of this band who is still alive, but is not present.

These twenty five gentlemen appear without dissent to have come to the conclusion that it was expedient to form a chemical society, and appointed a committee of fourteen to carry this resolution into effect. So expeditious were they in their work, that in little more than a month the first general meeting was held, and the provisional committee brought forward a report embodying a plan for the constitution and government of the society; and this plan remains essentially the same, save in one point, to the present day. I refer to the formation of a museum of chemical specimens. This project was abandoned some years ago. It is worth recording that at this first general meeting Thomas Graham was elected president; Messrs. W. T. Brande, J. T. Cooper, J. F. Daniell, R. Phillips, vice-presidents; Mr. Arthur Aikin, treasurer; Messrs. Robert Warington, E. F. Teschemacher, secretaries; council, Dr. T. Clarke, Rev. J. Cumming, Dr. C. Daubeny, Messrs. T. Everitt, T. Griffiths, W. R. Grove, H. Hennell, G. Lowe, W. H. Miller, W. H. Pepys, R. Porrett, Dr. G. O. Rees; also that the society then numbered seventy-seven members. We hail Sir W. Grove as being the most active member who is still among us in founding our society, for he was a member of the first council, was present at the first meeting, and was a member of the provisional committee. I must here add to the official record, for it does not tell us how these twenty-five gentlemen "interested in the prosecution of chemistry" were collected together at one time and place. Obviously some special force was required to build up this complicated molecule. That special force was embodied in and exercised by Robert Warington. By his activity and energy he brought about this meeting; and we can imagine how difficult and troublesome a work it probably was, how some of these gentlemen had to be instigated to action, others repressed, some convinced that the aim was desirable, others that it was feasible. But whatever the difficulties were, Mr. Warington succeeded, and to him we are indebted for the formation of our society. Although he has passed away, he is ably represented here to-day by his son. The love for the Chemical Society has proved to be hereditary. Mr. Warington of to day is a most active and valued member, is one of our vice-presidents, and, as our programme shows, is about to present to us records connected with the early history of our society which are of great interest now, and will become of increasing value as time goes on.

I turn now at once from these matters immediately connected with our society to the consideration of what was being done in chemistry in this country fifty years ago. At that time public laboratories for the systematic teaching of chemistry did not exist in London. The number of real students of chemistry in this coun'ry was very small. They

[1] From Nature.

were looked upon by their friends as being eccentric young men, who probably would never do any good for themselves; and these few students found practical instruction in the private laboratories of some of the London teachers.

The practical teaching of chemistry appears to have been undertaken in Scotland much earlier than in England, for Dr. D. B. Reid held practical classes at the University of Edinburgh as early as 1832. Graham came to London from Glasgow in 1837, and until the opening of the Birkbeck Laboratory, in 1846, he had from time to time private students working in his laboratory. And so with the other teachers, who all had private or articled pupils. I doubt whether the pupils received much systematic instruction; but they gained an insight into laboratory work; saw how apparatus was put together, and how analyses were made. We have indeed to wait some years before public laboratories are established, for not till 1845 is the College of Chemistry opened: and this appears to have been really the first public laboratory in London; and its object, as stated by its founders, is "to establish a practical school of chemistry in England." About the same time both University and King's College established laboratories. The council of our society recognized the importance of these occurrences: for in the annual report in 1847 they say, "Although an event not immediately connected with the society, the council has much pleasure in commemorating the late successful establishment in London of chemical laboratories expressly designed to further the prosecution of original research. The new laboratories of the College of Chemistry, and of the two older Colleges of the London University, now offer facilities for practical instruction and research not surpassed, we believe, in any foreign school."

While speaking of laboratories in London, I should, however, mention that the Pharmaceutical Society established a laboratory especially, if not exclusively, for its own students, as early as 1843.

It was not till several years later, till 1850 and 1851, that the medical schools in London established classes of practical chemistry.

If we consult the scientific journals of the time immediately preceding the formation of our society, we find it was by no means a period of chemical activity in this country, but rather a dull time, given more to the study and slow development of the science than to discovery. Methods of analysis, both organic and inorganic, had been much improved; and the dominant idea was the determination of the empirical composition of bodies, and the preparation of new compounds, whose existence was predicted by a study of Dalton's "Atomic Theory." Graham, Kane, and Johnson of Durham were the leaders in scientific chemistry, and the authors of the most important chemical papers of the time. Graham had very lately published his notable paper on the constitution of salts, — a paper which gained for him, some years after its publication, a royal medal. Kane was an active worker and a bold theorist, and at this time his reputation was much increased by a paper on the chemical history of archil and litmus. Johnson was also a most active chemist. His contributions relate to many branches of the science, but especially to the chemical composition of minerals. In 1841, however, he was engaged on a long series of papers on the constitution of resins. He will probably be best known and remembered as an agricultural chemist. Faraday we can hardly claim as a chemist at this time, for he was then rapidly publishing his long series of experimental researches in electricity. While speaking of electricity, I should state that it was in 1840 that Smee described his battery, and the Society of Arts awarded him a gold medal for it. An important branch of our science was, however, coming into existence, — a branch which has found many and successful investigators in this country. I mean photography. It was in 1840 that Herschel published in the "Philosophical Transactions" his elaborate paper on the chemical action of the rays of the solar spectrum, — a paper in which he recognizes a new prismatic color beyond the violet, and chemical activity in the spectrum beyong the red, and, besides discussing many other matters, establishes his previously discovered hyposulphite of soda as the best agent for the fixing of sun-pictures. Fox-Talbot had previously given an account of photogenic drawing, and claims that as far back as 1835 he took pictures of his house by means of a camera and chloride-of-silver paper; but it is not till 1838 that the secretary of the Royal Society extracts from him a clear account of the details of his process, and it is in 1841 that he is granted a patent for improvements in obtaining pictures or representations of objects. Again, in the following year, Herschel published another paper of much importance. I can here only mention how actively this line of research was prosecuted by Robert Hunt; how many, ingenious, and interesting were the experiments he made; and how valuable was the account he afterwards gave of this subject in his "Researches on Light." Thus the work done in this branch of chemistry at the time of which I am speaking is certainly noteworthy, probably more so than in other branches of chemistry. In fact, of other advances in chemistry there is little to record; but I may mention that Clarke's process for determining the hardness of water also holds its jubilee this year, for it was in 1841 that a patent was granted to Dr. T. Clarke for a new mode of rendering certain waters less impure and less hard.

Not a single chemical paper appears in the "Philosophical Transactions" for 1841; but there are two papers which were much discussed at this time, and, although they were readily shown to be erroneous, still are interesting as indicating the chemical ideas of the day. One is by Robert Rigg, who is carrying on an experimental inquiry on fermentation, and is termed "Additional Experiments on the Formation of Alkaline and Earthy Bodies by Chemical Action when Carbonic Acid is Present." It is published in the "Proceedings of the Royal Society." The other is a paper by Dr. S. M. Brown, entitled "The Conversion of Carbon into Silicon," and is published in the "Transactions of the Royal Society of Edinburgh."

With regard to the first paper, Mr. Rigg believes that he has demonstrated, that, when fermentation takes place, a great and direct increase in alkaline and earthy salts, viz., of potass, soda, and lime, occurs, — an increase varying from fifteen to nineteen times the original amount. Denham Smith, who has only very lately passed away, showed that the theory simply rested on inaccurate experiment.

The object of the other paper is to demonstrate, that, on heating paracyanogen, nitrogen is given off, and a residue of silicon remains. Dr. Brett and Mr. Denham Smith controverted this, and, in a paper in the *Philosophical Magazine*, proved that the supposed silicon was simply carbon in a very incombustible state. So important an experiment was this alleged conversion of carbon into silicon considered to be at the time of its publication, that it attracted Liebig's attention; and in a letter to Dr. Playfair, which was communicated to the meeting of the British Association at Plymouth in 1841, Liebig says he has repeated Dr. Brown's experiment on the

production of silicon from paracyanogen, but has not been able to confirm one of his results.

As far as pure chemistry is concerned, it was rather a time of repose. The beginning of the century had been a brilliant time for chemistry in England. Dalton had published his atomic theory; Davy had decomposed potash and soda, and had demonstrated that chlorine was an element; and Cavendish and Wollaston were then still at work. In fact, the most important discoveries of that time were made in this country; but I fancy that during this later period a feeling grew up that the age of brilliant discoveries was over, and that, apart from the preparation of a few new compounds, the essential work of the time was analysis and the determination of the percentage composition of bodies. Still much quiet study of the science was going on, as is indicated by the considerable demand which existed for good text-books. Henry's, Turner's, Kane's, and Graham's "Chemistry,"—all these, without mentioning others, went through numerous editions, and played a very important part in the spread of chemical knowledge in our country.

Another text-book, which is interesting as showing how little organic chemistry was studied in this country, is Dr. Thomas Thompson's work on "Vegetable Cemistry." Dr. Thompson states in his preface that the object of the book is to lay before the British public a pretty full view of the present state of the chemistry of vegetable bodies; and, further, he says "that the ultimate analyses he gives have, with very few exceptions, been made upon the continent, and principally in Germany and France. British chemists have hardly entered on the investigation." Evidently, then, at this time organic chemistry had been but little studied in this country.

When our society was founded, Thomas Graham was certainly the most distinguished chemist in England. He came to London in 1837 as professor of chemistry at University College, succeeding Edward Turner. The work he had already accomplished was of a high order, and he was now occupied in writing his book, which appeared in 1842

The book was an admirable account of the chemistry of the time. It contained a well-arranged and clearly written introduction, describing the principles and latest discoveries in those branches of physics which bear most directly on chemistry. There was also an able and succinct account, probably the best which had then appeared in this country, of organic chemistry; and with regard to physiological chemistry, he states in the preface that he gives a "condensed view of the new discoveries in this department, which now enters for the first time into a systematic work on chemistry."

There are, however, indications that a knowledge of the discoveries and discussions going on on the continent only slowly reached this country. This is strongly insisted on in the *Philosophical Magazine* of 1841, by Messrs. Francis and Croft, who state that "but little of what is done abroad, especially in Germany, seems to find its way into England, or at least until the lapse of some years." In proof of this statement, they mention results lately published by Dr. Apjohn, Professor Johnston, and Dr. Golding Bird, all of which had been known on the continent some time previously. A valuable series of communications, described as "Notes of the Labours of Continental Chemists," is afterwards communicated by these chemists to the *Philosophical Magazine*, and continued for several years.

The visit of Liebig in 1837, when he attended the meeting of the British Association at Liverpool, must have given some stimulus to the study of organic chemistry in England; and we find that he undertook to report to the British Association on isomeric bodies, and also on organic chemistry; and this great undertaking resulted in his two works, — the one "Chemistry, in its Application to Agriculture and Physiology;" and the other, "Chemistry, in its Applications to Physiology and Pathology." Both books were dedicated to the British Association, the first appearing in 1840, the second in 1842. It is very difficult for us now to realize the importance of these works, and properly to appreciate not only the large amount of new knowledge which they contained, but, what is of still greater importance, the novelty of treating such subjects in a truly scientific spirit. Gradually this treatment of the subjects became understood and appreciated, and people took a higher view of chemistry, and regarded it as a true science, and not merely as a study which might lead to useful results.

If, then, it be true that chemistry at this epoch was not rapidly progressing in this country, we naturally ask how it came about that our society from its very foundation was so successful. The explanation is not difficult to find, nor doubtful; for we have only to turn from our own country to the continent and learn what is happening there. Liebig is at Giessen; Wöhler at Göttingen; Bunsen at Marburg; Dumas, Laurent, Gerhardt, and a host of distinguished and active chemists, in France; and at this time even Berzelius and Gay Lussac are alive. Liebig, with his wonderful energy and ability, was powerfully advocating the theory of compound radicles, and was extending in every direction our knowledge of organic chemistry, and inspiring all who came within the range of his influence with a love for investigation. Dumas, at the same time, both as a chemist and a finished advocate, was advancing his views on substitution and chemical types. Laurent, and afterwards Gerhardt, were with conspicuous ability showing how these theories were to be extended and modified so as to assume a form which has, even with the lapse of time, been but little altered. Thus on the continent it was a time of wonderful activity. Chemistry was every day becoming more of a true science, and the constitution as well as the composition of bodies was actively being discussed and investigated. This activity on the continent took time to reach and really affect us here. The older chemists thought the new theories were visionary and unsound, the simple theories of their younger days were being swept away, and only slowly did they realize the meaning of the newer form of their science; but the wave of progress could not be stopped, and in this country we had been ripening for the change. Clearly the immediate cause of this sudden increase of chemical activity in England was Liebig. His famous school had now been established for several years at Giessen; and if the older men in this country did not altogether put their trust in him, the younger men, breaking through all restraint, flocked from this country to his laboratory, there to become indoctrinated with his enthusiasm for the study of chemistry, and to learn how scientific investigation was to be carried on. At this epoch our society was founded; and our journal shows how successful Liebig's teaching was, how a new spirit was instilled into English chemistry, and how much valuable work his students did. Our society gave them a ready means of publishing their discoveries, and a meeting-place for discussion and mutual interchange of ideas. Thus do I explain the success which from the first has attended on our society; and, having now led you to this point, I stop, for my part was merely to speak the prologue, and I leave the story of the society's development to others.

THE FEEDING OF FOWLS.[1]

On July 2, 1889, ten Plymouth Rock hens, one year old, and as nearly as possible of uniform size, were selected from a flock of thirty-five. At the same time ten chickens, hatched from the same hens mated with a Plymouth Rock cock, were similarly chosen. The chickens were about six weeks old, healthy and vigorous, and of nearly the same size. Up to the time of purchase, both hens and chickens had full run of the farm. The hens foraged for themselves, and were given no food. The chickens had been fed corn-meal dough, sour milk, and table-scraps.

A preliminary feeding-trial was continued for twenty-five days, during which time both hens and chickens were confined all together in a fairly well lighted and ventilated room, and fed a great variety of food, in order that all should go into the feeding-trial as nearly as possible in the same condition. During this preliminary feeding, both hens and chickens increased in live weight, — the ten hens from a total of 44 pounds 12 ounces to 47 pounds 1.5 ounces, or 3.75 ounces each, laying 93 eggs; the chickens, from a total of 9 pounds 15 ounces to 18 pounds, or 12.9 ounces each.

Food, shells, and water were kept constantly before the fowls. Basins which contained the food and water were kept within a box constructed of lath, so arranged that the fowls could reach between the slats and procure food and drink without wasting or soiling.

July 26 the hens and chickens were each separated into two lots of five each, as follows: hens, nitrogenous ration, weighed 23 pounds 8.5 ounces; hens, carbonaceous ration, weighed 23 pounds 9 ounces; chickens, nitrogenous ration, weighed 8 pounds 15 ounces; chickens, carbonaceous ration, weighed 9 pounds 1 ounce.

The four lots were placed in separate pens, where they remained during the entire experiment, which lasted one hundred and twenty-five days. They were fed and watered once daily, and an account kept of the food eaten and water drank. At each feeding the food and water remaining was weighed back, and deducted from the amount charged at the previous feeding.

The hens and chickens fed a nitrogenous ration were given daily all they would eat of the following mixture, — one-third part wheat-bran, one-third part wheat-shorts, one-third part cottonseed-meal, two parts skimmed milk, — and will be designated Lot I.

The hens and chickens fed a carbonaceous ration were given daily all they would eat of a ration of cracked maize and maize dough, and will be designated Lot II.

Both groups were given a small amount of green clover as long as it lasted, and afterward cabbage.

For convenience the experiment was divided into five periods of twenty-five days.

During the first period all the fowls seemed in good health except the carbonaceous fed chicks. They, during this as in all succeeding periods, were restless and peevish, always moping or hunting for something to eat, though their trough was filled. When fed, they would greedily take a few mouthfuls, and then, with their hunger still unappeased, would leave the dish. They always ate ravenously the green food which was given them, as did the hens and chickens of Lot I. The hens of Lot II., on the contrary, seemed quite willing to squat about the pen and subsist on the maize diet, and, strangely enough, cared little for green food. The clear maize diet was accompanied by such ill effects, that the chickens of each lot, after the first period, were given daily each one-fourth ounce of wheat, and the hens each one ounce. The wheat was increased during the fourth and fifth periods, in the case of the chickens, to one ounce each. During the second period, one of the chickens fed nitrogenous food, and during the third period another of the same lot, were taken ill and removed from the experiment. Both seemed to be suffering from impacted crops, as the stomach and gizzard in each case were found to be empty.

[1] Condensed from a thesis prepared for the degree of bachelor of science in agriculture, by James Edward Rice, a graduate of the class of 1890 of the College of Agriculture of Cornell University.

The fact that the sick chickens disliked the nitrogenous ration, and that since the first period the amount of food eaten by the hens and chickens of Lot I. had continually decreased, led to the belief that their food might be too nitrogenous; and as, during the last days of the third period, one of the hens in Lot I. was also ill, it was decided to discontinue the use of cottonseed-meal, and to use linseed-meal instead. The hen recovered soon after the change in food

The supply of skim-milk running short in the last two periods, water was used instead in mixing the ration of the lots fed nitrogenous food.

At the beginning of the fifth period one-half of the linseed-meal in the ration of Lot I. was removed, and cottonseed-meal substituted. This combination seemed a happy one, for on this ration both hens and chickens made large gains.

At the end of the experiment little difference could be seen in the hens of the two groups; but the two lots of chickens were in striking contrast. While the chickens fed on nitrogenous food were large, plump, healthy, active, and well feathered, the chickens fed on a carbonaceous ration were in general much smaller, sickly, and in several cases almost destitute of feathers Two of them had perfectly bare backs, and so ravenous were they for flesh and blood that they began eating one another.

The inability of the chickens fed on a carbonaceous diet to throw out new feathers, and the ability of the chickens fed on a nitrogenous diet to grow an enormous coat of feathers, is a splendid illustration of the effect of the composition of the food in supplying certain requirements of animal growth. It was plain to see that maize, even when assisted by a small amount of wheat and green clover, could not supply sufficient nitrogen for the growth of feathers.

While both lots of hens lost weight during the experiment, the loss was slightly greater with those fed nitrogenous food, but these produced by far the most eggs.

The chickens fed on nitrogenous food just about doubled in weight, while those fed on carbonaceous food only added about one-third to their weight.

During the first week the carbonaceous fed hens laid three eggs, while the others laid two. The two groups were therefore practically evenly divided at the start as to the condition of the laying stage. At the end of the first period the nitrogenous fed hens had laid forty-three eggs, and the carbonaceous fed hens had laid twenty. During the next twenty-five days the former laid thirty, and the latter six. During the third period the former laid six, and the latter not any. From this time on, no eggs were received from either group. The decline in egg-production was probably due in large part to the fact that the hens began to moult during the second period, and continued to do so during the rest of the experiment.

The eggs laid by the nitrogenous fed hens were of small size, having a disagreeable flavor and smell, watery albumen, an especially small, dark-colored yolk with a tender vitelline membrane, which turned black after being kept several weeks; while the eggs of the carbonaceous fed hens were large, of fine flavor, of natural smell, large normal albumen, an especially large rich yellow yolk, with strong vitelline membrane, which was perfectly preserved after being kept for weeks in the same brine with the other eggs.

Samples of the eggs from each lot of fowls were privately marked, and sold to a boarding-house where the cook did not know that the eggs were undergoing a test. On meeting the cook several days later, the following words were heard: "Do you expect me to cook such eggs as these? About every other one is spoiled."

On examination of the ovaries after slaughtering, it was found that in the case of one of the carbonaceous fed hens the ovules were in a more advanced stage, but, on the whole, the nitrogenous fed hens were much nearer the laying period. With this single exception, the cluster of ovules in the carbonaceous fed hens were uniformly small. Neither group would have laid under any probability for several weeks. It would seem from these facts, together with the fact that during the experiment the nitroge-

nous fed hens laid more than three times as many eggs, that a nitrogenous ration stimulates egg-production.

On Nov. 27 the fowls were slaughtered. Each fowl was weighed, wrapped in a bag to prevent floundering, and killed by severing an artery in the roof of the mouth. The blood was caught in a glass jar. The fowls were then picked and the feathers weighed, after which the body was laid open longitudinally by cutting alongside the sternum and through the backbone. When all had been thus prepared, they were hung up in groups to be photographed, but the photographs were quite unsatisfactory so far as showing the relative proportions of fat and lean.

One half of each fowl was tested by cooking for flavor, succulence, and tenderness: the other half was carefully prepared for chemical analysis by separating the meat from the bones. The flesh was thoroughly mixed and run through a sausage-cutter, mixed again, and the process repeated three times. From different parts of this mixture a large sample was taken, from which the chemist took his samples for analysis. The right tibia of each fowl was tested for strength by placing it across two parallel bars and suspending a wire on its centre on which were placed small weights until the bone gave way.

Dressed Weight, Internal Organs, etc.

	HENS.		CHICKENS.	
	Lot I. Nitrogenous.	Lot II. Carbonaceous.	Lot I. Nitrogenous.	Lot II. Carbonaceous.
Live weight, pounds	21.81	22.00	17.89	12.63
Dressed weight, pounds	14.88	15.09	12.01	8.89
Dressed weight per hundredweight, pounds	69 70	68.60	67.10	70.50
Weight of blood, pounds	.75	.66	.55	.34
Weight of feathers, pounds	1.41	1 25	1.28	.66
Weight of intestinal fat, pounds	.59	1.98	.84	.66
Weight of offal, pounds	3.70	3.02	3.62	2.08
Weight of bones, pounds	3.47	3.63	3.18	2.69
Weight of flesh, pounds	11.39	11.47	8.93	6.20

The breaking strain of the right tibia was as follows for the hens and chickens of the various lots: —

Average, hens, nitrogenous	48.16
Average, hens, carbonaceous	51.74
Average, chickens, nitrogenous	46.64
Average, chickens, carbonaceous	31.18

There was little difference in the strength of the bones of the hens, undoubtedly because the bones were mature before the feeding began, and were little affected by the feeding. We find, however, that the bones of the chickens fed on nitrogenous food were almost fifty per cent (49.6) stronger than those fed carbonaceous food.

The flesh of each group was submitted to a number of persons for a cooking test, and the almost unanimous verdict was that the flesh of the fowls fed a nitrogenous ration was darker colored, more succulent, more tender, and better flavored, though on this last there was some difference of opinion.

So far as it is warrantable to draw any conclusions from a single experiment of this kind, it would seem that chickens fed on an exclusive corn diet will not make a satisfactory development, particularly of feathers; that the bones of chickens fed upon a nitrogenous ration are fifty per cent stronger than those fed upon a carbonaceous ration; that hens fed on a nitrogenous ration lay many more eggs, but of smaller size and poorer quality, than those fed exclusively on corn; that hens fed on corn, while not suffering in general health, become sluggish, deposit large masses of fat on the internal organs, and lay a few eggs of large size and excellent quality; and that the flesh of nitrogenous fed fowls contains more albuminoids and less fat than those fed on a carbonaceous ration, and is darker colored, juicier, and tenderer.

FEEDING STEERS OF DIFFERENT BREEDS.

IN Bulletin No. 69 of the Michigan Agricultural Experiment Station Mr. Eugene Davenport, agriculturist of the station, remarks that it has long been known that other influences than food operated decidedly to affect the gains of a feeding animal. The individual variation is great, often if not always easy to foresee, but impossible to estimate, hence the benefit of selection; and every feeder knows that as much depends upon the selection of the bunch of feeders as upon their after-care.

The question has arisen in the minds of men, whether or not, by the various standards of selection employed in the establishment of breeds, any important differences have resulted; and whether or not, properly speaking, there are such things as breed differences aside from form, color, etc.; and, if so, what are their character and extent? Are they sufficient to distinguish one breed above another?

This question was made the basis of two extended feeding experiments by the Michigan Station with steers of different breeds. The first is reported in full in Bulletin No. 44, and the second forms the subject of Bulletin No. 69.

Though primarily conducted as an experiment between the breeds. Mr. Davenport prefers to present the records and data independent of that question, — to discuss it in other bearings as well, and discover, if possible, what other circumstances may have exerted influences upon the gains, retaining till the close of the discussion the question of the breeds.

The influence of different kinds of feed-stuffs has not entered into this experiment. The idea has been to feed them alike, using a mixed grain diet, and giving some variety both in grain and coarse fodder, and to adjust the amount of both at all times to the appetite of the individual animal. The rations of all the steers have been at all times precisely alike, except as to amount and some slight variations which they established themselves between grain and coarse fodder.

Every opportunity possible has been afforded, regardless of expense, for individual differences and breed peculiarities to appear.

Neither this nor any similar experiment is absoutely just to all the breeds. The conditions have been made alike for all, except as to the amount of food each chose to take. But like conditions cannot be taken as being equally favorable to all. The framing of an experiment which should afford each its best conditions would include those so dissimilar as to make the results not capable of comparison. Likely this is as well as could be done, though it certainly affords conditions more nearly natural to some than to others. There is no doubt, that if they had been kept in open yards, with a higher proportion of coarse fodder, the results would have been greatly different, both absolutely and relatively. The whole experiment may be taken as one employing a heavy grain ration, for the bunch consumed as many pounds of grain as of coarse fodder if the latter had been equally dry.

The plan was to secure as nearly typical specimens of the breeds as possible. There were originally two each of the five breeds, Galloway, Holstein, Hereford, Short-Horn, and Devon, but accidents deprived the station of one of the Short Horns and one of the Devons.

It is not thought that either breed suffered in the loss. It is to be regretted, but it is not always possible to carry ten animals for two years and a half and all remain in every way normal. This is mentioned lest the experiment be criticised for furnishing only one specimen of these two breeds. This loss is to be regretted, for even the two is too small a number to estimate their personal equation; and not till after that is done can any difference in breeds be fully established.

The grain ration was made up of corn and oats (either whole or

ground), with bran and some preparation of oil-meal. The proportions varied from time to time, but was always the same for all the animals. No molasses was used, nor condiments of any sort.

The coarse fodder was principally mixed hay (timothy and clover), relieved by roots (mangels, turnips, etc.), corn-ensilage, cut grass or corn, and in the early part by pasture. During the first summer they were on pasture a large part of the time for about four months, too long for their best good. The last summer they were out from May 17 to June 6, and rested from grain. This resulted in a temporary loss of weight, but a real advantage to the steers.

The results of this experiment seem strongly to confirm the following: —

1. The amount of food consumed is no index of the amount of gain it will produce; that is, to its profitable use and conversion into meat.

2. Neither is the total gain secured, nor the rate of gain, a sure guide to the economical use of food by the animal.

3. Large gains are not necessarily economical ones, nor medium ones necessarily costly.

4. Age is the all-controlling circumstance that decides the rate of gain. The ration necessary to sustain the gain increases with age in about the same proportion as the weight of the animal, but the gain remains absolutely about the same.

5. That "baby beef" is not inconsistent with high quality.

6. That nervousness is not necessarily a sign of a bad feeder.

7. That great development in size is not a necessary condition to profitable feeding nor to quality.

8. That the "type" of an animal has much to do with his ability to use food to good advantage in the production of meat. In this sense there is a distinction and a difference between the breeds for beef purposes.

9. Those nearest the "dairy type" made less gain to the food consumed, and it consisted more largely of fat on and about the internal organs. This type was also characterized by coarser extremities; a longer, flatter rib; more shrinkage of meat in cooling; and a higher percentage of cheap parts.

10. As between the beef breeds, Mr. Davenport thinks no one can here suggest marked differences that cannot be sufficiently explained on other grounds. As in all experiments of this kind, greater differences are noticeable within the breeds than between them. The two Herefords are in this experiment nearly at extremes in every thing but type, and in that respect as far apart as is allowable among Herefords. Aside from the Holsteins, no two animals of the lot differed more than did the two Herefords. Very close upon them came the two Galloways, with marked differences in build.

11. Knowing these animals as he did, Mr. Davenport thinks he may safely say, that as they, irrespective of breed, approached a certain stocky, blocky form, designated as the "meat type," in the same degree they proved good feeders and economical consumers of food within a reasonable age. On the other hand, as they approached the coarser or more loosely built organization, betraying a circulation more largely internal and less diffused, in about the same proportions were they less profitable consumers of food for meat purposes, and turned out a less desirable carcass for the block. If this be true, it is a question of type rather than of breed; and that breed that affords the largest proportion in members of this type is, all things considered, the best, if any one thinks he knows which breed or breeds that may be.

In saying this, Mr. Davenport believes that he only follows the teachings of this and all other experiments. Nor does it work any injustice to other types selected for and excelling in other special lines. All will make some beef. Only a few will make the best or the cheapest. The strong teaching in this is, that moderate gains are not inconsistent with profit, nor lack of age inconsistent with quality.

An experiment of this kind is attended with much expense and labor. Many a careful thought and laborious hour go to secure what passes into a few tables. If only it shall assist a little in the establishment of knowledge and of truth, and not at all in fostering an error, then every one will be well paid.

OUTLINE OF THE HISTORY OF COMMERCIAL FERTILIZERS.[1]

THE history of commercial fertilizers practically dates back to the time when bones were first applied to the soil, and their value as a fertilizer was recognized. Fertilizing with bones was first practised in England. Probably the first instance of their extensive application was in the case of the farmers living near Sheffield, England, who applied to the land the bone and ivory clippings which were waste products of the knife and button factories of Sheffield. These clippings amounted to about eight hundred tons a year, and were regarded, until about a century ago, as a nuisance, the disposal of which was a serious problem to the manufacturers.

In 1774 the agricultural use of bones was first publicly recommended by Hunter, and successful experiments were made with bone-dust.

About 1814, Alexander von Humboldt called public attention to the use of guano as a fertilizer, which he had seen used by the natives of Peru.

About 1817 the first super-phosphate is believed to have been made by Sir James Murray.

It was not until after 1820 that the use of phosphates assumed any great commercial or agricultural importance, and not even then was it appreciated what gave bones their value as fertilizers.

About 1830, Peruvian guano began to be imported into Europe as a fertilizer, and, a few years after, into the United States, especially at the South.

About 1840, Liebig published the results of his researches, and suggested that plants must obtain materials for their growth from the soil as well as from the air and water, which alone were previously supposed to furnish plant-food, and hence that the proper life of a plant can be benefited by furnishing those elements that are necessary. It was shown that the phosphate of lime in bones gave them their value, and that by dissolving bones with sulphuric acid they were made much more effective. The demand for bones then outran the supply. Other sources were looked for, and in 1843 a new source of phosphate of lime was found in Spain, consisting of a rock which contained considerable amounts of phosphoric acid. On trial, this rock was found to be a substitute for bone.

In the United States, farmers first used bones about 1790. The first bone-mill was built about 1830, and super-phosphates were first used in 1851. The discovery of the so-called South Carolina rock was a great boon to those using commercial fertilizers, as this was found to take the place of bones.

The investigations based upon Liebig's theory showed that other elements in addition to phosphorus must be used to secure the best results, and gradually commercial fertilizers containing other elements came to be manufactured and offered for sale.

LETTERS TO THE EDITOR.

Ohio State University.

BY the recent passage of the Hysell Bill in the Ohio Legislature, which levies a tax of one-twentieth of a mill on every dollar of taxable property in the State, some attention has been turned toward this institution.

The institution was founded in 1862. At that time the State received from the United States 630,000 acres of land; and now the fund from the sale of this land is nearly $540,000, and yields an income of over $32,000.

The legislature has made liberal appropriations from time to time, but the trustees and faculty have hesitated to lay out very extensive plans, for this support was not entirely sure; but, now that this can be depended upon, plans for increasing the facilities of the institution will be carefully considered. The tax will bring the university $90,000 each year, which, together with what it receives from other sources, places Ohio on her feet in the educational race; and she will soon be in advance of her weaker sisters,

[1] From Bulletin No. 26 of the New York Agricultural Experiment Station.

and, instead of holding twenty-fourth rank in education, she will soon take a place in the front, if not in the lead.

The institution has experienced steady growth ever since it was founded. The number of students has increased, and new buildings have been erected for their accommodation. The last one was built in the fall of 1890, and is devoted exclusively to veterinary medicine and science. The new chemical laboratory, dedicated last month, is constructed according to the latest improved plan, and students have the best opportunities for study in all branches of chemistry. In the botanical laboratory is found specimens of plant-life from many parts of the world, and several herbariums both of our own flora and many plants from other countries.

In the mechanical laboratory is found tools and power for the various branches of mechanical art. The physical and electrical laboratories are supplied with the necessary appliances and apparatus for those studies.

The departments of physiology, geology, and zoölogy are in the main building, and are as well equipped as the former circumstances would allow. Students are encouraged, in the natural sciences especially, to original and independent investigation; and to facilitate this, excursions are made to places of especial geological, botanical, or entomological interest. In connection with the university is a biological club, consisting largely of professors and students who are doing advanced work in biology.

Among the many needs of the institution may be mentioned a hall for military drill, a fire-proof building in which to place the valuable geological and botanical museums and the library, more class-rooms, and better equipment in all departments. Other departments will be added to the institution, whose needs, with those of the present departments, will be well supplied; for the aggregate support is now adequate to a great institution, which Ohio State University is destined to be. E. E. BOGUE.

Columbus, O., April 8.

BOOK-REVIEWS.

Mixed Metals, or Metallic Alloys. By ARTHUR H. HIORNS. London and New York, Macmillan. 12°. $1.50.

IN this serviceable and timely volume Mr. Hiorns not only brings his subject up to date, but deals with it in a manner well adapted to the requirements of students and practical men. In these particulars he has followed the same methods used by him in his previous works in the same line, — "Elementary Metallurgy," "Practical Metallurgy," and "Iron and Steel Manufacture." We wish, though, he had omitted the first clause of his title. "Mixed metals," no matter how common the term may be in the metal trade, cannot fairly be considered as equivalent to "metallic alloys:" in other words, a true alloy is not a mere mixture of metals. Aside from this, there is no fault to find with the book.

Publications received at Editor's Office, March 30–April 4.

CAMMANN, D. M. The Physical Diagnosis of the Diseases of the Heart and Lungs and Thoracic Aneurism. New York, Putnam. 188 p. 16°. $1.25.

DAVIES, T. A. Am I Jew or Gentile? Read and see. New York, E. H. Coffin. 87 p. 16°.

FLUGEL, F. A Universal English-German and German-English Dictionary. Vol. I. Part 1. Braunschweig and New York, Westermann. 192 p. 4°. $1.00.

KNOFLACH, A. A Sound-English Primer. New York, Stechert. 68 p. 12°.

LANKESTER, E. R. Zoological Articles contributed to the "Encyclopædia Britannica," etc Edinburgh, Black; New York, Scribner. 195 p. 4°. $5.00.

MAXWELL, W. H. Advanced Lessons in English Grammar. New York, Cincinnati, and Chicago, Amer. Book Co. 327 p. 12°. 60 cents.

NEWSDEALER'S and Publisher's Bulletin. Vol. I., No. 1. March 2, 1891. New York, Newsdealer's and Publisher's Bull. Pub. Co. 24 p. 4°. $1 per year.

QUACKENBOS, J. D., and others. Appletons' School Physics. New York, Cincinnati, and Chicago, Amer. Book Co. 544 p. 12°. $1.20.

SMITHSONIAN INSTITUTION, Annual Report of the Board of Regents of the, showing the Operations, Expenditures, and Condition of the Institution to July, 1889. Washington, Government. 815 p. 8°.

U. S DEPARTMENT OF AGRICULTURE. Proceedings of the Seventh Annual Convention of the Association of Official Agricultural Chemists held at the U. S. National Museum, Aug. 28, 29, and 30, 1890. Washington, Government. 238 p. 8°.

Much yet remains to be learned on the subject of which it treats; but that which is already known, or at least the essential or available part of it, is lucidly presented.

The author takes up the subject of alloys where ordinary metallurgical treatises finish with it, and goes at once into the practical side of it, including the various uses to which the alloys are put. He also gives a brief account of the properties of the separate metals, and of the effects of certain elements upon them. Commercial metals are not chemically pure; and as the presence of impurities often produces characteristic results, which may be a useful guide, this part of the book will have a special value to manufacturers. A short account of chemical terms and principles is given for persons not familiar with chemical processes.

AMONG THE PUBLISHERS.

THE American Academy of Political and Social Science has just issued the fourth number of its *Annals* The volume just issued deals with the "Genesis of a Written Constitution," by Professor Morey of Rochester; "Natural Law," by Professor Taylor of Michigan; "Compulsory Voting," by Mr. F. W. Holls of New York; and "The Wealth Concept," by Professor Tuttle of Amherst. Another article treats of economic instruction in Italy, and gives an account of the university system. The proceedings contain a discussion of the Original Package decision by Messrs. Budd and Wintersteen of the Philadelphia bar. In addition to the *Annals*, the American Academy of Political and Social Science issues from time to time supplementary volumes of interest to students of economics and politics. The first of these, the "History of Statistics," by Professor August Meitzen of Berlin, has just appeared.

— Heinemann of London announces a new volume dealing with the much-discussed Marie Bashkirtseff, entitled "The Social Life of Marie Bashkirtseff, being Extracts from her Letters and Journals, illustrated with Drawings and Studies."

SCIENCE

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PROTECTION FROM LIGHTNING.

PROSPECTUS.

47 LAFAYETTE PLACE, NEW YORK, March 9, 1891.

It is proposed by the owners of letters patent dated Dec. 16, 1890, on an improved method for protecting buildings from lightning, etc., to organize a company for the handling of said patent and all improvements; and subscriptions are requested on the following terms and conditions:—

1. A company is to be organized with a capitalization of $10,000, in 1,000 shares of $10 each, fully paid in at par, the company to be organized in such State as the subscribers may determine by vote when all shares have been subscribed for, and with a charter to contain a provision that the amount of capitalization shall never be increased.

2. This $10,000 is to be used as working capital; and the object of the company will simply be to place licenses with responsible persons, corporations, or sub-companies, at such rates of royalty as may be agreed upon by a majority vote.

3. In lieu of any stock or cash payment to the inventor for his patent, the inventor will give said company the exclusive control of his said inventions in consideration of the payment to him by said company of one-third of the gross royalty receipts.

The officers of the company shall be elected by a majority vote of the stockholders without reserve. No stock shall be given to anybody for services or any thing else except actual cash payment at par into the treasury.

No subscriptions will be binding until the full number of 1,000 shares has been subscribed for.

Subscriptions are solicited in amounts from five shares upwards. The list opens with subscriptions for **one hundred and five** shares.

N. D. C. HODGES.

BUSINESS OPPORTUNITY.

There is a good chance for the right man as Manager of the

LIGHTNING PROTECTION COMPANY,

which is being formed to operate under broad patents. The new method will certainly revolutionize the whole system of protecting property from lightning.

Local companies are already forming to operate under licenses from the parent company, and we should be glad to hear from any who would care to consider entering this new field.

Correspondence is solicited with those desiring further information.

N. D. C. HODGES, 47 Lafayette Pl., N.Y.

CALENDAR OF SOCIETIES.

Anthropological Society, Washington.

April 7. — Lester F. Ward, Are the Acquired Mental Faculties of Man Hereditary?

Philosophical Society, Washington.

April 11. — J. P. Iddings, The Rocks of Obsidian Cliff, National Park; J. W. Powell, Evolution of Industry.

Boston Society of Natural History.

April 15. — R. R. Andrews, The Development of the Enamel of the Teeth (illustrated by the stereopticon).

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED—A position in some College, Normal School or Academy to teach Biology, Physiology, Comparative Anatomy, Histology, Embryology or Botany. A graduate of the University of Wisconsin. Have had four years' experience as a teacher. Address "BIOLOGIST," care SCIENCE.

WANTED.—All of Vol. I. of *Journal of Analytical Chemistry*, published at Easton, Penn. State price and condition. SCIENCE BOOK AGENCY, 47 Lafayette Place, New York.

WANTED—A position in a Summer School of Gymnastics to teach any one or more of the following named physical exercises, viz.: Fencing (to ladies especially), Sparring, Club Swinging, Wands, Chest Weights and Free Movements. Am prepared to offer very favorable terms to any school desiring such work. WILLIAM FINDLAY, Proprietor of Phila. Inst. of Phys. Cult., 1009 Arch Street, Philadelphia, Pa.

A COLLEGE GRADUATE—has had four years' experience in analytical laboratory and in works—desires position in chemical works, oil refinery, or paint works, or in any position where a technical chemist is needed. Address "CHEMIST," care *Science*.

A HARVARD M.A., especially interested in Natural History, would like to learn of some outdoor occupation for the summer. Remuneration a secondary object. SUMMER, *Science* Office.

A CHEMIST, taking P. G. work in the Scientific Department of one of our best colleges, would like to negotiate for some industrial position, where his knowledge would be of avail. Can furnish best of references. R. S. W., Box 691, Amherst, Mass.

WANTED—A position to teach Electrical Engineering by a student from leading English and French and U. S. science schools, or would accept position as Consulting Electrical Engineer, Electrician, etc. Very highest testimonials London & Hartford Publishing Co., N. Y. (International Press Department.)

WANTED.—A young man in college would like a position during the summer of 1891 in some scientific work, particularly Orinthology, either as an instructor or tutor, or in making collections or accompanying some scientific expedition. Can give good references. Address HUBERT L. CLARK, Amherst, Mass.

WANTED.—A young man who has been teaching in a first-class High School desires a position in a similar institution. Is competent to teach Mathematics, Latin, Book-keeping, and the English branches. Can give highest references Address H. W. MARTHENS, 6208 Broad St., Pittsburgh, Pa.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

Will exchange a new Thomson reflecting astatic galvanometer, about 6,000 ohms, made by Clark, Muirhead & Co, London, and costing £30, with 1-9, 1-99, 1-999, shunts, lampand scale, for a Weston voltmeter and ammeter, or arge Wheatstone bridge, dial pattern, or a portable testing outfit. Address G. A., *Science* Office, 47 Lafayette Place, New York.

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

I have a good supply of Eastern Coleoptera which I wish to exchange for species not in my collection. Melandryidae and Oedemeridae especially desired. Joe C. Thompson, Rosebank P. O., Box 73, S. I.

SCIENCE

NEW YORK, APRIL 17, 1891.

EUROPE DURING AND AFTER THE ICE AGE.

TEN lectures under this title have been given by Professor James Geikie of the University of Edinburgh, beginning March 13 and ending April 10, as one of the courses of the Lowell Institute, Boston.

Beginning with descriptions of the physiography of Europe and of the present glaciers of the Alps, Professor Geikie afterward described successively the glacial deposits of the Alps and adjacent lower lands, of the British Isles, and of the Scandinavian Peninsula, northern Germany, Finland, and north-western and northern Russia. The accompanying map of Europe at the climax of the glacial period delineated the maximum area of the European ice-sheet nearly as it is mapped in this author's "Prehistoric Europe," but represented it as extending farther north-east, so as to cover the northern part of the Ural Mountains. A very perfect demonstration of the origin of the till or bowlder-clay by the agency of land-ice is supplied by this order of presentation, first considering the development of the till, moraines, and glacial striæ, in the valleys and lowlands bordering the Alps, where glaciers still exist, being evidently the shrunken representatives of their formerly much greater extent during the glacial period or ice age. No theorist has ever claimed a marine origin for these glacial deposits. Thence Professor Geikie proceeds to the similar Scottish till, which in all its characteristics and in its distribution, scanty in the valleys of the mountains and highland districts, but spread thickly on the lowlands, is manifestly the exact analogue of the Swiss ground-moraine. Both, therefore, are attributable to land-ice. And the same argument includes likewise the similar but far more extensive deposits of till and fluvio-glacial detritus which thickly cover the low tracts of Sweden, Denmark, northern Germany, and a large part of Russia. During the final melting of the ice-sheets, much of the finest detritus which had been incorporated with their lower portion was borne far away by rivers, and deposited as loess in the valleys and on flat lands, or in some places in broad shallow lakes.

One interglacial epoch, and perhaps more than one, interrupted the severe cold of the ice age in Europe. For a long time, between two epochs of glaciation and accumulation of till, a mild interglacial climate permitted southern animals and plants to extend into Great Britain and northern Germany; and during this time the ice-sheets were doubtless wholly melted away, or were as much restricted as now, remnants of them lingering only in the Alps and on the mountainous plateau of Scandinavia.

After this mild and even warm interval, which was of long duration, the glaciers of the Alps again spread out to the lowlands, but not so far as before; and ice-sheets were again accumulated upon the British Isles, Scandinavia, Finland, and northern Germany, but they too were less extensive than in the earlier glacial epoch. The British ice-sheet during that earlier epoch had extended south to the Thames; but the ice of the later epoch, according to Professor Geikie, though again wholly enveloping Scotland, reached into England only to Lincolnshire. The earlier British ice-sheet certainly, and the later one probably, were confluent with the ice which deployed from Scandinavia southward in a broad *mer de glace* over the area of the North Sea, bringing Norwegian bowlders to the shores of England. All of Scandinavia, excepting a small tract of southern Sweden, appears to have been covered by the ice-sheet of the latest glacial epoch, which also, as mapped by Professor Geikie, reached east over Lapland to the White Sea, and over Finland nearly to Lakes Onega and Ladoga, but did not cover the Gulfs of Finland and Riga. Toward the south and west, however, the "great Baltic glacier," a lobe of this latest ice-sheet of north-western Europe, filled the basin of the Baltic Sea and overflowed the low northern margin of Germany to Berlin, and the eastern half of Denmark. The extreme limits of the earliest European ice-sheet are not generally marked by terminal morainic accumulations, but rather by extensive stratified deposits of gravel and sand. On the other hand, the later glaciation is bounded in many places by prominent hilly and knolly terminal moraines, with abundant erratic blocks.

Since the ice age, there is evidence, in the fossil faunas and floras of marine deposits and peat bogs, that north-western Europe has experienced for some time a climate considerably warmer than that of the present day; and the speaker compared this with the formerly warmer waters of the Atlantic on the shores of New England and the eastern provinces of Canada, which allowed various species of southern mollusks in the post-glacial or recent epoch to extend northward to the Gulf of St. Lawrence, though now they have become mainly extinct north of Cape Cod, excepting a few colonies that survive in favorable localities. These climatic changes following the glacial period unite the whole quaternary era as characterized from its beginning to the present day by numerous alternations from severity to mildness of climate, and the reverse.

Inquiring what were the causes of the ice age, Professor Geikie pointed out its complex character, with two or more epochs of severe climate and ice accumulation, divided by recession of the ice and long-continued mild conditions; and he especially called attention to the Alpine glaciation and the ice-sheets of north-western Europe as simply the increased and greatly extended development of the glaciers that still are found in Switzerland and Scandinavia. A lowering of the mean temperature of Europe by twelve degrees might gradually restore the ice-sheets. The short estimates of the time (7,000 to 10,000 years) that has passed since the latest glaciation of the northern United States, given by N. H. Winchell, Andrews, Gilbert, and Wright, from their consideration of the recession of waterfalls and erosion of river-gorges, as stated in Wright's "Ice Age in North America," are pronounced by Professor Geikie unreliable; and he maintains the astronomic theory of his friend and colleague, the late Dr. James Croll, which accounts for glacial epochs by eccentricity of the earth's orbit, placing the close of the latest glaciation

about 80,000 years ago. But Professor Geikie shows that man, using paleolithic or rough stone implements, was living in France and southern England during this last glacial epoch. When the latest ice departed, permitting men to extend north over Scotland and north-western Europe, they had already reached their neolithic stage, using smoothly ground and polished stone implements.

The alternative theory of the cause of the accumulation of ice-sheets, which is held by Dana, Upham, and LeConte, ascribing the cold climate to elevation of the glaciated areas as high plateaus, so that they would receive snowfall during the greater part of the year, seems to Professor Geikie very improbable, and a large portion of his last lecture was devoted to its refutation. This explanation, however, would accord with the estimates of the length of post-glacial time before noticed, and would seem more consistent with the probable antiquity of man, and with his known rate of development of skill in the manufacture of implements and in all the useful arts.

TREATMENT OF FUNGOUS DISEASES.[1]

THAT many of the most destructive diseases of cultivated plants can be and are every year almost completely controlled, is a fact perfectly well known to those who are familiar with the subject; but it has as yet come to be realized by very few, relatively, of those to whom it is of the greatest importance,— farmers, gardeners, fruit-growers, florists, amateurs, and others.

The practicability and great money value of proper treatment in the case of various plant-diseases, which, in the absence of such treatment, would reduce the yield of important crops to almost nothing, have already become apparent to some cultivators who have been progressive enough to try for themselves, or who live near the experimental fields or orchards of experiment stations, or of progressive neighbors. The vast majority, however, of those who should be most interested have been heretofore too indifferent or too sceptical even to investigate the basis of the very strong and positive statements which have been made concerning the efficacy of preventive treatment for fungous diseases of plants.

From the nature of parasitic fungi, and the fact that they are for the most part parasites within the tissues of their hosts, it is evident that our efforts must be directed toward preventing their attacks. The present state of our knowledge does not enable us to stop the development of a parasite within its host-plant, without injury to the host, after it has once obtained a foothold.

The various forms of preventive treatment for a given disease fall naturally under two heads,— field and orchard hygiene, and individual protection. The former includes the minimizing of all sources of infection by the removal of rubbish, of remains of diseased plants or fruits, or of wild plants which may serve as propagators of the disease. The latter includes the application to the plants to be protected of substances in liquid or solid form which shall fortify them against the attacks of fungi which cause disease. Such substances are known as "fungicides." Since different fungi attack their hosts in very different ways, since their modes of development and the effects which they produce differ widely, it is plain that no all-embracing rule can be laid down for the treatment of fungous diseases. Certain principles of general applicability can, however, be stated, certain general directions can be given, and instructions regarding the preparation and application of those fungicides which have been proved to be most useful and effective can be furnished.

There are definite laws of health for plants as well as for animals; and in one case, as in the other, neglect of those laws invites disease. In the first place, plants which are expected to grow and thrive must be furnished with an abundance of the materials necessary to growth. Weak, poorly nourished plants suffer the attacks of parasites of all sorts, and have no power to resist them. Second, where a crop has suffered from a fungous disease in one season, and a good crop of the same kind is desired in the following season, every tangible trace of the disease must be removed. For example: if a vineyard has suffered from mildew or black rot, all diseased leaves and berries should be collected at the end of the season with scrupulous care, and wholly burned; and the same advice applies to a large list of cases. Thus incalculable numbers of the spores of the fungi of the respective diseases will be prevented from infesting the next season's crop. In some cases where the spores remain in the soil, as in the stump-foot of cabbages or the smut of onions, the attacks of the disease can only be avoided by rotation with crops upon which the fungus in question cannot live. Third, wild plants, which, being nearly related to a given cultivated one, may be subject to the same disease, or which bear a complementary spore-form of a pleomorphic fungus, should be carefully excluded from the neighborhood of cultivated ones. Thus, wild cherries or plums, which are equally subject to the black-knot, should be kept away from plum-orchards, and spinach-fields should be kept free of pig-weed, since both plants are attacked by the same mildew; and again, since red cedars bear one spore form of a fungus whose other form is the rust of apple-leaves, it is plain that they should not be allowed to grow near an apple-orchard.

Now, when the general hygienic conditions have been made as unfavorable as possible to the development of disease, we may resort finally to the special protection afforded by the use of fungicides.

These preparations, when properly prepared and when applied at the right times and in the right way, have been abundantly proved to be of the greatest value, and often to determine the difference between a full crop from plants on which they are used and practically no crop where they are not applied.

But the fact cannot be too strongly emphasized that every thing depends upon how they are prepared, and upon how and when they are applied. The bulletin gives somewhat full instruction how to prepare and apply the most valuable fungicides, and such general hints when to apply them as will be of service. The proper times for their application vary so much with special conditions, however, that instructions on this point must form an important part of the special directions for any particular case.

The protective quality of most of the best fungicides lies in the fact that they contain a certain proportion of copper; and, of the four recommended as applicable to most cases of fungous diseases, three contain it as the essential constituent.

The Bordeaux mixture requires six pounds of sulphate of copper, four pounds of quicklime (fresh), and twenty-two gallons of water.

The sulphate of copper, known to the trade also as blue vitriol or blue-stone, is dissolved in two gallons of water. The solution will be hastened if the water be heated and the sulphate pulverized. After the solution is complete, fourteen gallons of water are added to it. The quicklime is slaked in six gallons of water, and stirred thoroughly until it forms a smooth, even mixture. After standing for a short time, it is again stirred, and added gradually to the sulphate solution, which is thoroughly stirred meanwhile. The mixture is then ready for use, though some experimenters recommend further dilution to twenty-five or thirty gallons for certain uses. It should not be prepared until needed, and should be used fresh, as it deteriorates with keeping. Since the lime remains merely in suspension, and is not dissolved, the mixture should be strained through fine gauze before entering the tank of the spraying-machine, so that all of the larger particles which might clog the sprayer may be removed.

Ammoniacal carbonate of copper, in its improved form, is prepared from three ounces of carbonate of copper, one pound of carbonate of ammonia, and fifty gallons of water.

Mix the carbonate of copper with the carbonate of ammonia, pulverized, and dissolve the mixture in two quarts of hot water. When they are wholly dissolved, add the solution to enough water to make the whole quantity fifty gallons. This preparation has been found to be better and cheaper than that made according to the original formula, which is as follows:—

Dissolve three ounces carbonate of copper in one quart *aqua*

[1] Abstract of Bulletin No. 39 of the Massachusetts State Agricultural Experiment Station, for April, 1891, by James Ellis Humphrey.

ammonia (22° B.), and add the solution to twenty-five gallons of water.

Dr. Thaxter of the Connecticut Experiment Station suggests that a very large saving may be made by preparing the carbonate of copper by the following method, instead of buying it, as its market price is much greater than that of the materials necessary for its preparation. Take two pounds of sulphate of copper and dissolve it in a large quantity of hot water; in another barrel or tub dissolve two and one-half pounds of carbonate of soda (sal soda) in hot water. When both are dissolved and cooled, pour the soda solution into the copper solution, stirring rapidly. There will result a blue-green precipitate of carbonate of copper, which must be allowed to settle to the bottom of the vessel. Now draw off the clear liquid above the sediment, fill the vessel with fresh water, and stir up the contents thoroughly. After the copper carbonate has once more settled to the bottom, again draw off the clear fluid above. The carbonate may now be removed from the vessel and dried, when it is ready for use. From the amount of blue-stone and sal soda given above will be produced one pound of copper carbonate, and the amount of each necessary to produce any given amount of copper carbonate is easily calculated.

Sulphate of copper is used in solutions of varying strength for certain special cases.

Sulphide of potassium, known also as sulphuret of potassium or liver of sulphur, has been found useful in the treatment of diseases caused by those fungi known as "powdery mildews," especially on plants grown under glass. It is ordinarily used in the proportion of half an ounce of the sulphide to one gallon of water.

The one of the above fungicides chosen as most available under existing conditions is now to be applied to the plants which it is desired to protect against disease. In the special case of the grain smuts, the only effectual treatment is that applied to the seed-grain, since these fungi depend for their propagation upon the spores which adhere to the grain and germinate with it. They cannot attack the host-plant after it has fairly passed the seedling stage, and the adhering spores may be killed before planting without injury to the seed. But ordinarily the fungicide must be thoroughly applied to the whole of each growing plant in the form of a fine spray, so that the plant is completely wet, but not flooded. Perhaps a practical measure of the proper amount of a fungicide to be applied to a plant may be obtained by stopping as soon as the plant is wholly wet, and before the solution begins to drip from it. In order to insure a fine and even spray and economy of materials, especial care should be used in securing proper nozzles. The ordinary spraying-nozzles used with hose or with small hand-pumps are utterly unsuited to this purpose.

As has been said, the question when to apply is of the first importance in dealing with any disease, but the answer varies with the case in hand. In general, however, let it be remembered that all treatment is preventive, that plants once attacked are lost, and that spraying must therefore be prompt and early. In the case of a disease of an herbaceous crop like potatoes, the first spraying should be given at once on the appearance of the disease in any part of the field or in a neighboring field. The same applies to diseases of woody plants, which have previously been free from disease; but where grapes or apples, for instance, were attacked last year, treatment should begin with the beginning of growth, and should proceed on the assumption that the disease will re-appear if not prevented. In any case, after spraying is begun, it must be repeated until danger is past (a very variable period) at intervals which may average ten days or two weeks, but will vary according to circumstances, depending especially on the amount of rainfall, which washes the copper salts from the plants, and renders a new application necessary. It is always best to leave an occasional plant or row of plants untreated among the treated ones, to furnish a basis for judgment as to the efficacy of the treatment.

It is earnestly hoped that many persons in the State who have suffered in the past from fungous diseases will this year undertake definite measures to avoid such losses, and will communicate early their intention to do so to the station.

SCHOOL OF APPLIED ETHICS, SUMMER SESSION.[1]

BEGINNING early in July, and continuing six weeks, there will be held at some convenient summer resort in New England or New York a school for the discussion of ethics and other subjects of a kindred nature. The matter to be presented has been selected with regard to the wants of clergymen, teachers, journalists, philanthropists, and others who are now seeking careful information upon the great themes of ethical sociology. It is believed that many collegiate and general students will also be attracted by the programme. Speakers and subjects will be, so far as arranged, as follows: —

I. Department of Economics, in charge of Professor H. C. Adams, Ph.D., of the University of Michigan.

Professor Adams will deliver eighteen lectures (three during each of the six weeks) on the history of industrial society in England and America, beginning with the middle ages, and tracing genetically the gradual rise of those conditions in the labor world which cause so much anxiety and discussion to-day.

Along with this main course will be presented (1) three lectures by President E. Benjamin Andrews, — one on the evils of our present industrial system, one on socialism as a remedy, and one on the better way; (2) three lectures by Professor Frank W. Taussig, Ph.D., — one on distributive and credit co-operation, one on productive co-operation and profit-sharing, and one on workingmen's insurance; (3) three lectures by Hon. Carroll D. Wright on factory legislation; (4) three lectures by Professor J. B. Clark, Ph.D., on agrarian questions, discussing rent and tenure, and considering the agrarian element in the farmers' alliance movement; (5) three lectures by Albert Shaw, Ph.D., — one on the housing of the poor in Paris, one on the housing of the poor in London, and one on Gen. Booth's scheme for relieving poverty (the first two of these lectures will have especial reference to the question of rapid-transit facilities in cities); (6) three lectures by Professor E. J. James, Ph.D., on labor and industrial legislation in Europe.

In addition to the above, two lectures are expected from Mr. Henry D. Lloyd of Chicago, giving chapters in the industrial history of the United States.

If there be sufficient demand for it, special instruction in the principles of economics will be provided.

II. Department of the History of Religions, in charge of Professor C. H. Toy, D.D., of Harvard University.

Professor Toy will offer a general course of eighteen lectures, extending through the six weeks, treating the history, aims, and method of the science of history of religions, and illustrating its principles by studies in the laws of religious progress, with examples drawn from the chief ancient religions. Among the topics will be the classification of religions, conceptions of the Deity, religion and superstition, sacrifice and the priesthood, the idea of sin, religion and philosophy, religion and ethics, sacred books, religious reformers and founders.

The provisional scheme for the special courses is as follows: "Buddhism," Professor M. Bloomfield, Johns Hopkins University; "The Babylonian-Assyrian Religion," Professor M. Jastrow, University of Pennsylvania; "Mazdeism," not yet provided for; "Islam," Professor G. F. Moore, Andover Theological Seminary; "The Greek Religion," not yet provided for; "The Old Norse Religion," Professor G. L. Kittredge, Harvard University.

It is hoped also to arrange a set of Sunday-evening lectures, in which the positions of various religious bodies, Catholic, Protestant, and Jewish, will be expounded by prominent members of these bodies.

III. Department of Ethics, in charge of Professor Felix Adler, Ph.D., of New York.

Professor Adler will offer a general course of eighteen lectures, extending through the six weeks, on the system of applied ethics, including a brief survey of the various schemes of classification adopted in ancient and modern ethical systems, the discussion of the relation of religious to moral instruction, of the development of the conscience in the child, etc. The scheme of duties treated will embrace personal ethics, social ethics in general, the ethics of

[1] From April number, International Journal of Ethics.

the family, the ethics of the professions, the ethics of politics, the ethics of friendship, the ethics of religious association. The scheme of duties will be treated with special reference to the moral instruction of children.

The provisional programme for the special courses in this department is as follows: "Introduction to an Ethical Theory," three lectures by W. M. Salter; "The Treatment of the Criminal by the State," three lectures by Dr. Charlton T. Lewis; "Ethics and Jurisprudence;" "The Ethical Ideal of the State;" "History of Temperance Legislation." The names of special lecturers not given will be announced later.

The tuition for the entire school, including all the lectures in the three departments, will be ten dollars. Notice of the place determined upon will be published at an early date. For fuller information in reference either to the instruction or to arrangements for boarding, and the like, application should be made to Professor H. C. Adams, dean of Summer School of Applied Ethics, 1602 Chestnut Street, Philadelphia, Penn.

HEALTH MATTERS.

Vaccination in France.

THE *London Medical Recorder*, Feb. 20, 1891, says, "The French Academy of Medicine is just now the scene of a struggle between those who are in favor of a law making vaccination compulsory, and the others who think that the present permissive system goes as far as is consistent with personal liberty. The general in command of the 'volunteers,' that is to say, of those who object to compulsory protection, is no less an authority than Professor Léon Le Fort, and last week he made a vigorous rally from behind his intrenchments, and, with heavy artillery in the shape of arguments, he prevented the further advance of the attacking forces. There are several points in Professor Le Fort's address which merit attention, especially as the matter is at present under consideration in this country. First of all, — and the news will come as a surprise to those who have been in the habit of regarding France as being at the prow of civilization, — all statistics based on the mortality returns from the different diseases must be incomplete, and therefore misleading, for the cause of death is only recorded for statistical purposes in the more important French towns, and presumably not at all in the rural and smaller urban districts. What the total annual mortality from small-pox in France may be, can therefore only be matter of conjecture. Still, the professor admits that it is certainly higher than it ought to be or need be. Another fact, hardly to the credit of French provincial authorities, is, that nowhere outside Paris is any attempt made to isolate the sufferers from small-pox. He is therefore compelled to fall back upon the Paris returns; and these show that the mortality has been steadily diminishing, from 32 per 100,000 inhabitants, during the period 1865–76, 55 per 100,000 in 1880–87, to 5 per 100,000 in 1889. The returns of the Small-pox Hospital at Aubervilliers testify to the same diminution, the admissions and deaths having been as follows: —

	Admissions.	Deaths.
1887	1,400	215
1888	1,079	153
1889	706	63
1890	363	37

"There are no available means of ascertaining the proportion of cases of small-pox per 100,000 inhabitants in the country, still less the proportion of deaths to cases of infection. We are, however, told that country doctors have the greatest difficulty in procuring lymph, and the people have the greatest difficulty in getting vaccinated, even supposing they were so disposed.

"Let us compare these figures with the German statistics. It must be borne in mind that vaccination has been compulsory throughout Germany since 1835, and in some parts since 1815. The returns are as follows: —

	Deaths per 100,000 Inhabitants.
1834	54
1836	19
1847	9
1856	7

"In 1865 the war led to a relaxation of the stringent rules in respect of isolation, and forthwith the number of deaths from small-pox jumped up to 46 per 100,000, and in the following year to 62. During the Franco-German war, small-pox was imported into Germany by the returning soldiers, and more particularly by the French prisoners of war; and the mortality from variola in 1871 attained 59,839, and 77,000 in 1872, equal to 238 per 100,000 civilians, and 31 per 100,000 of the military population. In 1874 the vaccination law was consolidated, and a vaccination service founded for the supply of lymph, and by 1877 the number of deaths (810 in 1876) had fallen to 88. This level, however, was not maintained, for in 1382 the figures had again risen to 1,007. Thereupon the German Government enjoined more stringent measures for isolation, and then the downward tendency returned, and in 1886 the number of deaths was 140 only.

"In England in 1885 — a time when vaccination had long been in full swing, but when isolation was not seriously enforced — the number of deaths from small pox in London alone was 1,419. In 1886 the number fell abruptly to 24; in 1888, to 9; and in 1889, to 1. This diminution coincided with the introduction of isolation on a large scale, which reached its apogee with the law for compulsory notification in 1889.

"Professor Le Fort argues from these figures, that, though vaccination has an undoubted and valuable influence in affording protection and in mitigating the severity of the disease, the most effective and reliable means of preventing the spread of the disease is rigorously enforced isolation.

"While it is impossible to deny the salutary influence of isolation, it seems a trifle inconsistent to object to vaccination as an infringement of the liberty of the subject, while rallying to the principle of compulsory isolation, which is as directly in contravention of personal liberty as any measure well could be. To take a patient, *non volens*, and shut him up for eight long weeks in a hospital, is surely as obvious an attack on his liberty as to insist on his submitting to the trivial operation of vaccination. This question of personal liberty, unfortunately, does not admit of any categorical reply. Different people have different ideas as to what constitutes liberty, and as to what limits, if any, are to be assigned to its play. Still, the great object that we have in view, is to secure cheerful submission to an infliction imposed by reason rather than by law; and if this could be attained by persuasion, instead of coercive legislation, then the choice would be easy."

NOTES AND NEWS.

THE Legislature of Arkansas has continued the geological survey of that State, and Dr. J. C. Branner has been re-appointed State geologist by the governor. It is expected that the work will be completed during the next two years. A report on manganese will be published by this survey in about a month.

— Miss Emma Garrett has resigned her position of principal of the Pennsylvania Oral School for the Deaf, to take effect June 20, in order to devote her time to establishing a home for the training in speech of deaf children before they are of school age. Miss Garrett will continue her Normal Training School for Teachers of the Deaf, established in 1881. She will have a summer school this year to accommodate some teachers desiring training at that time. For further particulars address her at Scranton, Penn.

— Bulletin No. 12 of the Hatch Experiment Station of the Massachusetts Agricultural College is a report on insects, by C. H. Fernald of the Division of Entomology. The history of the insects, and the methods of destroying or holding them in check, have been worked out at the station or compiled from the most reliable sources. This last has been done because there have been

so many demands for information about the common insects as to cause the expenditure of a large amount of time in answering inquiries about them. Numerous experiments on insecticides have been conducted during the past two years, but with such results that Mr. Fernald does not feel ready to report them as yet.

—In the winter and spring of 1887 and 1888, the steamer "Albatross" made a cruise from Norfolk, Va., to San Francisco, in the service of the United States Fish Commission. The collection made at this time in the harbor of Bahia, and a small collection made in deep water off Cape San Matios in north-eastern Patagonia, form the subject of a paper by David Starr Jordan, president of the University of Indiana, and containing a list of fishes obtained in the harbor of Bahia, Brazil, and in adjacent waters, published by permission of Hon. Marshall McDonald, commissioner of fisheries, in the "Proceedings of the United States National Museum," vol. xiii. The collection from Bahia includes one hundred and twelve species. As the number of specimens taken does not exceed two hundred, it is evident that the results which would have come from extensive collecting might have been exceedingly valuable.

—An ingenious process of spinning and welding copper pipe has recently been introduced in America, says *Engineering* of March 27. The inventor, Mr. J. H. Bevington, discovered that if a tube was made to enter an annular bell-mouthed die, revolving at a sufficient velocity, the diameter of the tube was reduced to that of the hole through the die, and thus a copper tube could be reduced in diameter to any desired extent. The friction between the surfaces of the die and the tube is so great that the latter is softened locally by the heat, and flows easily. If the bottom of the die be closed, the end of the tube will be welded over, and the end solidly closed. By a modification of the process two lengths of tubing can be welded together.

—The sixth annual meeting of the American Association for the Advancement of Physical Education was held in Boston, April 3 and 4. Dr. D. A. Sargent presiding. The papers read were as follows: "Is Physical Training a Trade or a Profession?" by the president; "Physical Education in Colleges," by Rev. W. D. Hyde, D.D.; "A Comparison of Measurements of Men and Women from our Colleges," by E. Hitchcock, M.D.; "The Growth of Children," by Professor H. P. Bowditch, M.D.; "The Delsarte System of Æsthetic Exercises," by Mrs. Coleman Bishop; "Physical Education in the Young Men's Christian Association," by Luther Gulick, M.D.; "Athletics *versus* Gymnastics at Home and Abroad," by E. M. Hartwell, M.D.; "Physical Training in the Regular Army," by Charles R. Greenleaf, M.D., U.S.A.; "Some of Galton's Tests," by Kate C. Hurd, M.D.; "A System of Gymnastic Exercises for Public Schools," by Mr. Carl Betz; "The Muscular Strength of Growing Girls," by C. L. Scudder, M.D. At the business meeting Dr. E. M. Hartwell was elected president for the coming year.

—The prizes offered by the American Economic Association for the best essays on the subject of women wage-earners have just been awarded. There were about thirty competitors for the prize. The first prize, of three hundred dollars, was given to Miss Clare de Graffenreid of Washington, D.C. The essay written by Mrs. Helen Campbell of New York received the second prize of two hundred dollars. The essayists were invited to discuss "the early and present condition of working-women; their growth in numbers, both absolutely and in proportion to population; the present extent of their sphere of labor; the economic and social evils connected with their various occupations as wage-earners, and the remedies for these evils." They were asked to deal principally with the American aspects of the subject, though it was not intended that the experience of foreign countries should be excluded. Miss de Graffenreid is a descendant of Baron de Graffenreid, one of the eminent companions of Oglethorpe, who planted a colony in Georgia. Her father was a lawyer of distinction who resided in Macon, where she was born, and spent her early days. Her girlhood was passed amid the strife and strain of the civil war. After her father's death she taught in a private school some thirteen years. She has always been interested in educational and social questions. After her appointment, in 1886, to the position in the United States Department of Labor, which she at present holds, her studies led her into a very active acquaintance with the industrial conditions of this country. In her economic studies she has travelled over a large part of the East, West, and South. In company with Miss Dodge, she spent a month last summer in London, investigating the conditions of labor there. A recent number of *The Century* contains an article from her pen on the Georgia Cracker, and she was one of the two who equally divided a prize offered by the Economic Association in 1889 for an essay upon child-labor. This essay has been published. A paper by Miss de Graffenreid, on "The Needs of Self-Supporting Women," has also been published in connection with "Johns Hopkins University Studies in History and Politics." Mrs. Helen Campbell is a native of Lockport, N.Y. She contributed sketches to magazines and newspapers at an early age, and later gave special attention to problems relating to the condition of the poor in cities. She began in October, 1886, a series of articles on the working-women of New York, which appeared weekly in the *New York Tribune*, and was subsequently published in book form with the title "Prisoners of Poverty." Similar observations, in person, were continued the year following in London, Paris, Italy, and Germany, the results of which were embodied in her "Prisoners of Poverty Abroad." Besides this, she has written a number of novels and books on related topics. The first prize essay will probably soon be published by the association.

—A press despatch from Paris, dated April 10, says that an enormous reservoir of water one hundred and twenty feet below the surface has been discovered at El-Golea, a small caravan station in the midst of the Sahara Desert. The reservoir was discovered while a number of workmen were sinking a well at El-Golea. The shaft sunk already gives forty gallons of good, clear water per minute, and it is expected that this amount can readily be increased should it be found that a larger quantity is necessary. This is said to be the first time that water has been found at so slight a depth in the Sahara.

—An appeal for funds for aiding in the teaching of speech and lip-reading to the deaf has been issued by William Pepper, provost of the University of Pennsylvania; D. Hayes Agnew, M.D.; Emma Garrett, principal of the Pennsylvania Oral School for the Deaf, Scranton, Penn.; Horace Howard Furness; Lawrence Turnbull, M.D.; Charles S. Turnbull, M.D.; J. Solis-Cohen, M.D.; Harrison Allen, M.D.; Wharton Sinkler, M.D.; Edw. H. Magill, ex-president of Swarthmore College; Charles C. Harrison; Thomas Chase, ex-president of Haverford College; and Mary S. Garrett. In the appeal it is stated that it has been demonstrated that deaf children can be taught speech and lip-reading, be educated, and be enabled to communicate with their families and friends through the same; and a number of pure oral schools for such instruction are in existence in the United States. To the complete success of the method, however, it is necessary that these deaf children should be guided and trained to speech from the age when hearing children begin to learn to talk. As the majority of these children are poor, and as all mothers, even of those who are not poor, do not understand how to train them to speech. Miss Fuller, principal of the Horace Mann Day School for the Deaf (pure oral), Boston, established, two years ago, a home for the training in speech of deaf children before they are of school age. The necessary funds for commencing the good work in New England were raised by the mother of a successfully trained deaf child. The children are, of course, under the care of persons specially trained for that purpose, and their progress already gives great encouragement. Miss Fuller, who has been principal of the Horace Mann Day School for the Deaf for many years, says, "Does it not seem almost unaccountable that the earliest years of deaf children's lives have been so long overlooked in the plans for their mental development?" It is proposed to establish in the Middle States, as speedily as possible, such a home as Miss Fuller has established in New England; and the public are earnestly requested to contribute to the endowment fund required for the same. Subscriptions may be sent to Frank K. Hipple, 1340 Chestnut Street, Philadelphia, Penn., who has consented to act as treasurer.

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LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

The Horned Saurians of the Laramie Formation.

IN 1872 Professor Cope made known the remains of a very large dinosaurian reptile from the transition beds of Wyoming, whice he named *Agathaumas sylvestris*. The portion of the skeleton found "rested in the midst of vegetable *débris*, as sticks and stems, and was covered with many beautiful dicotyledonous leaves, which filled the interstices between the bones." The animal was discovered near Black Buttes Station, on the Union Pacific Railroad, fifty-two miles east of Green River, and near the Hallville Coal-Mines. Professor Cope succeeded in recovering sixteen vertebræ, including a perfect sacrum, with dorsals and caudals; both iliac and other pelvic bones, those of one side nearly perfect; some bones of the limbs, ribs, and other parts not determined. Professor Cope's description is thus:—

"The vertebræ are large. The dorsals are short, with vertically oval centra and small neural canal. The diapophyses originate well above the neural canal, diverge upwards, and are triangular in section. The neural spine is very much elevated, and the arch short antero-posteriorly. The zygapophyses are close together in both directions, those of the same aspect being separated by a narrow keel only. They do not project, but consist of articular surfaces cut into the solid spine. The latter is flat, and dilated distally. The articular faces are nearly plane, with a slight median prominence. The ribs have two articular surfaces, but I found no capitular pit on the dorsal centra.

"Elevation of centrum, 7.5 inches; width of the same, 5 inches 7.5 lines; length of same, 3 inches 8.5 lines: total elevation of a dorsal vertebra, 28 inches 3 lines. The sacrum consists of five vertebræ, the anterior centrum not depressed. They give out huge diapophyses, which are united by suture. They are themselves united distally in pairs, each pair supporting a longitudinal convex articular face for the ilium. Each pair encloses a perforation with the centra. The first diapophysis goes off from the point of junction of the first and second vertebræ; the second from the third only, and is more slender. The total length is 25 inches, and the width 30 inches. Its vertebræ are flat below, with latero-inferior angles. The last centrum gives off a simple diapophysis. . . . The iliac bone is extended antero-posteriorly. One extremity is thick and rather obtuse, but of little depth. There is a large protuberance above the acetabular sinus. The other extremity is dilated into a flat, thin plate of rather greater length than the shorter extremity. The total length is about four feet, of which the acetabular sinus measures about 8.10 inches."

Professor Cope continues, "From the above description, it is evident that the animal of Black Buttes is a dinosaurian reptile, the characters of the sacral and iliac bones alone sufficing to demonstrate this point." It is pronounced the largest dinosaur described from North America.

This animal was described again and figured by Professor Cope in the "Vertebrata of the Cretaceous Formations," 1875: "On eight (and perhaps nine) vertebræ, anterior to the sacrum, there is no indication of the capitular articular facet for the rib [on the centrum]. This facet is found, as in *Crocodilia*, at or near the base of the elongate diapophyses. The centra are slightly concave posteriorly, and still less so on the anterior face, with gently convex margins. The neural canal is very small, and the neural arch short and quite distinct from the centrum, having scarcely any suture. The diapophyses are long and directed upwards. They are triangular in section."

The sacrals are then described, and the opinion is expressed that the tail is small: "The reduced and rather elongate form of the last sacral vertebra induces me to believe that this animal did not possess such large and short caudal vertebræ as are found in the genus *Hadrosaurus*, and that the tail was a less massive organ."

There cannot be any doubt that we have in *Agathaumas* a form widely different from any thing described before, clearly characterized by its peculiar sacrum and ilium.

Professor Marsh has created a new name, *Triceratops*, for this genus. That *Triceratops* is the same as *Agathaumas* will be admitted by everybody who will compare the figures published by Professor Cope, of the sacrum, the ilium, and the posterior dorsals, with the corresponding figures given by Professor Marsh. In the *American Journal of Science* (February, 1891) Professor Marsh makes this statement, "The posterior trunk vertebræ have also short, flat centra, but the diapophyses have faces for both the head and tubercle of the ribs, as in crocodiles, a feature not before seen in dinosaurs." Exactly this condition exists in *Agathaumas*, but also, as is well known, in *Iguanodon*. I think any further comment on the identity of *Agathaumas* and *Triceratops* is useless. Everybody can satisfy himself of this fact by comparing the figures of Professors Cope and Marsh.

I shall now show that *Ceratops* Marsh is the same as *Monoclonius* Cope.

In 1876 Professor Cope described a new, very remarkable dinosaur from the Fort Union beds of Montana, under the name of *Monoclonius crassus*.

"*Char. Gen.* — Teeth with obliquely truncate face and distinct root which is grooved for the successional tooth on the front; no external cementum layer; caudal vertebræ biconcave, and brim narrow; fore-limbs large and massive. The teeth of this genus resemble those of *Hadrosaurus*, and, like them, are replaced from the front, — an arrangement which precludes the possibility of more than one series of teeth being in functional use at one time. The robust fore-limbs and elongate ilium distinguish *Monoclonius* [misprinted *Diclonius*] from *Hadrosaurus*. From *Trachyodon* it differs in the absence of the rough cementum layer on the back of the tooth.

"*Char. Specif.* — The faces of the teeth are acuminate oval in form, and are divided by an elevated keel, which is median above, but turns to one side at the base; margin crenate, the grooves extending more or less on the curves back, which is otherwise smooth; sacrum with ten vertebræ; the last centrum much compressed; the diapophyses extending horizontally from the neural arch above, and connected by a vertical lamina with the iliac supports; length, 27.33 inches. The bones of the limbs are robust, the hinder the longer, but not so much so as in some other genera. Length of femur, 22 inches; width proximally 7.4 inches, distally 6 inches. Length of tibia, 20 inches; greatest diameter proximally 8 inches, distally 7.25 inches. The three anterior dorsal vertebræ are co-ossified, and the first exhibits a deep cup for articulation with the preceding vertebra. The episternum is a T-shaped bone, thin, and keeled on the median line below. Length of transverse portion, 21 inches."

It is evident that the structure of the sacrum at once shows the close affinity of this genus to *Agathaumas*. The description of the sacrum can be applied fully to the sacrum figured by Professor Marsh under the name of *Triceratops*. The description of the fore and hind limbs also agrees very much with that of *Triceratops*, and there is not the slightest doubt that *Monoclonius* belongs to the same family. *Monoclonius* and *Ceratops* are from the same locality, Cow Island, Montana; and the portions of the skull figured by Professor Cope (*American Naturalist*, August, 1889) leave no doubt whatever that *Monoclonius* is identical with *Ceratops*. The elements formerly considered by Professor Cope as episternum represent the parietals. I know and have examined the types of *Monoclonius* and *Ceratops*, and can state that the two forms are not generically distinct. In the April number of the *American Journal of Science* a restoration of *Triceratops* is given by Professor Marsh. I think there is no evidence that the animal had such a long tail as the restoration shows. The post-pubis, the presence of which I had predicted (*American Naturalist*, June, 1890), is not represented. In the February number of the *American Journal of Science* Professor Marsh makes the following remarks about the pubis: "One pubis recently discovered has a short, splint-like process, which may, perhaps, be a remnant of a post-pubic element, although it does not have the position of the post-pubic bone in other dinosaurs." Now, there cannot be the slightest doubt that this process is the same element as in the other *Iguanodontia*, and I do not see that it differs in position. The "splint-like process" is not complete behind, and I predict again that this process extended very much farther behind, just as in the allied *Iguanodontidæ*.

One of the characters now given by Professor Marsh to the horned saurians consists in the presence of a pineal foramen. This is evidently a mistake. The foramen described as a pineal foramen has nothing whatever to do, even if it really exists in all the skulls, with the true pineal foramen. This foramen is absent in all *Iguanodontia*, and it certainly would not make its appearance again in such a highly specialized animal as *Agathaumas*. I have nothing to add in regard to the teeth. I repeat, that they have not two true roots (compare the *American Naturalist*, June, 1890). The lumbars of the *Agathaumidæ* are not absent, as stated by Professor Marsh, but are simply co-ossified with the sacral vertebræ. The statement that the post-frontals meet in the middle line I take the liberty to doubt.

The *Agathaumidæ* (this is the only name which can be given to this group) represents a highly specialized family of the *Iguanodontia* (*Orthopoda*), the nearest allies of which are exhibited by the *Iguanodontidæ*.

The *Agathaumidæ* contain two forms which are well defined (I neglect here the horned saurians *Cratæomus* of the Gosau formation, Austria, of which only fragments are known),— *Agathaumas* Cope, 1872 (*Bison* Marsh, 1887; *Triceratops* Marsh, 1889; *Sterrholophus* Marsh, 1891), and *Monoclonius* Cope, 1876 (*Ceratops* Marsh, 1888). *Polyona* Cope, I think, is also a synonyme of *Agathaumas*.

This result is different from that reached by Professor Marsh, who states in the February number of the *American Journal of Science*, 1891, "The generic names *Agathaumas, Cratæomus, Monoclonius*, and one or two others, have been given to fragmentary fossils which may belong to this group; but these remains, so far as made known, appear quite distinct from those here described" (*Ceratops, Triceratops*). G. BAUR.

Clark University, Worcester, Mass., April 2.

The Shrike.

A PLEASANT article, chiefly concerning the shrike, or butcher-bird,— one of John Burroughs's bright articles,— calls to my mind some questions concerning the food of the shrike. Burroughs says that the shrike kills lizards, toads, birds, etc., by striking them on the head, then eats the brains only, and hangs up the carcass. What for?

Professor A. Newton, in "Encyclopædia Britannica," says the shrike hangs up its prey, or impales it, for greater convenience in tearing the carcass to pieces in order to devour it. I have seen a shrike's nest *in situ*. Around it hung a beetle, a mouse, a small bird, and a big bumble-bee. All were within reach of the bird as she sat on her eggs. A dart forward of her head brought her beak upon any one of these victims. For what were they hung up? For traps, I venture to suggest.

The shrike, no doubt, strikes its prey on the thin skull-bone. Let us say that instinct teaches that here is the spot most vulnerable for a beak no larger than that of the shrike. The exposed brain presents a soft eatable morsel, and the shrike eats it *en passant*. Then it hangs up its booty, and straightway the decaying carcass attracts insects, blue-flies notably, and thereon the shrike feasts. I believe that the shrike is chiefly insectivorous; and its habit of hanging up plunder, making a kind of larder all about its nest, is to call there plenty of large flies, which can be safely picked off as the bird sits on her eggs. True, the shrike hangs up carcasses far from its nest; but to these carcasses it can return frequently for the flies they have attracted. No doubt the instinct which suggests converting the vicinage of the nest to a shamble will prompt the bird to hang up whatever is killed by it, in the place nearest at hand. JULIA MCNAIR WRIGHT.

Fulton, Mo., April 7.

Iroquoian Etymologies.

IN an article in *The American Anthropologist* (vol i. No. 2) suggesting an Algonquian origin for the word "Iroquois," the writer had occasion to criticise a derivation given to this word by Mr. Horatio Hale, in his "Iroquois Book of Rites." This criticism is as follows:—

"Mr. Hale finds what he believes to be at least a possible origin in the indeterminate form of the Iroquois word *garokwa* ('pipe,' or 'string [error for "portion"] of tobacco'), *ierokwa* ('they who smoke,' briefly 'tobacco people'), the Iroquois being well known to have cultivated tobacco. With reference to this derivation, I am not aware that *garokwa* is used as a verb in any of the Iroquoian tongues. If not so used, it cannot, of course, have an indeterminate form, *ierokwa;* if this form existed, it would mean, not 'they who smoke,' but 'one smokes by which.'"

In the next issue of the quarterly named above, Mr. Hale tried, in "Indian Etymologies," to defend his erroneous derivation which had been called in question by the writer. Among other things equally remarkable, he says, "I have no desire to criticise it, but may be allowed to vindicate my own suggestion from the imputations of ignorance or carelessness, which his objections seem to imply. For this object it is not necessary to claim a profound knowledge of the Iroquois tongue, which is one of the most difficult of languages; but Mr. Hewitt, who has read my volume on the 'Iroquois Book of Rites,' might, perhaps, have reasonably given the author credit for a more careful study of the first principles of the language than he seems willing to suppose. With reference to my suggested derivation of the word from the verbal form *ierokwa* ('they who smoke,' reminding one of 'The Tobacco People,' which was a well-known designation of a Huron tribe), Mr. Hewitt remarks, 'I am not aware that *garokwa* is used as a verb in any of the Iroquoian tongues." If he will refer to the volume just mentioned, he will find, on p. 116 (paragraph 2), the word in question used as a verb in this native composition. The form here employed is *denighroghkwaien*."

If *denighroghkwaien* were an instance of the stem of *garokwa* used as a verb, it would prove Mr. Hale's position and the justness of his remarks; but, unfortunately for Mr. Hale, it is not such an instance. This will be shown in the sequel.

Moreover, Mr. Hale's contention that a mere superficial knowledge of the tongue is sufficient preparation to enable one to analyze accurately its terms and sentences is inconsistent and self-contradictory: since, if it be true that the Iroquoian tongue is "one of the most difficult of languages," then, before putting forth any etymologic analysis of its vocables and sentences, it is not only necessary, but imperative, to have a knowledge of its grammatic and morphologic processes sufficiently "profound" to enable the student attempting an etymology to ascertain the several parts of speech, their flexions, and their positions in sentence-words, because such a knowledge will prevent him from mistaking the

several parts of speech for real or fictitious flexions, and will prevent him from dividing sentence-words and derivative words in a capricious and erratic fashion, to give plausibility to etymologies and methods of verbal analysis based on a fatuous misconception of the structure of the language.

Moreover, the discriminating student, in pursuing his researches, will soon find that there is no published work on Iroquoian etymology and grammatic usage sufficiently elementary and accurate to be considered decisive authority in such matters; and whoever relies mainly or exclusively on published materials for his data and proofs should not be surprised to learn that his work is not scientific and not trustworthy, and that he labors without profit and without the attainment of truth.

Before beginning his analysis of *denighroghkwaien*, Mr. Hale changes its spelling to *tenirokwaienn*, in an attempt, as afterwards appears, to give validity to his fanciful derivation of it.

Mr. Hale puts forth this analysis in the following language: "*teni*, 'we two' (thou and I); *rokwa*, the 'theme' of the noun *garokwa* or *karokwa* ('pipe'); *i*, a vowel inserted for euphony; and *en* (or *enn*), the terminal inflection of the present imperative, in the second conjugation."

This alleged derivation is erroneous, and clearly at variance with all the structural and grammatic principles of the language.

For orthoepic reasons, the writer will employ, in the present analysis, the orthography *tenihrokuayĕñ* instead of the spelling adopted by Mr. Hale.

The true etymology of *tenihrokuayĕñ* is as follows: *te* (meaning "two") qualifies the noun-stem; *ni* (denoting "thou and I") is the pronominal prefix of the inclusive dual first person; *hrokua* (denoting "pipe," and "a portion of tobacco") is the noun-stem; *yĕñ*, Mr. Hale's *ienn* (signifying "to place," "put," or "lay down"), is the verb-stem, being in the exhortative mode, which in this language has no mode-sign, notwithstanding Mr. Hale's unfounded assertion to the contrary. Hence etymologically this sentence-word means, "Let thee and me lay [our] two pipes down," and figuratively, "Let thee and me smoke." It is thus evident that *tenihrokuayĕñ* (for *denighroghkwaien*) is not an instance of the noun-stem *hrokua* used as a verb.

Thus it is seen that Mr. Hale errs, first, in making the dual numerative *te* a part of the pronominal prefix; second, in virtually begging the question by miscalling the noun-stem *hrokua* a "theme," to give some plausibility to his erroneous assumption that it can have, as required, either a nominal or a verbal office, better to accord with his illusive treatment of it in his supposed etymology; third, by mistaking a common verb for an "inflection" unknown to the language, by his division of the well-known verb *ienn* (*yĕñ* in the writer's lettering) into a vowel *i* for euphony, and his supposed mode-sign, *enn*.

In Iroquoian grammar the fact that a certain stem is combined with verb-stems to form compound or sentential words, is conclusive evidence that such a stem belongs to the class of generic or abstract nouns which cannot have a verbal function in addition to their nominal office.

A generic noun is one the stem of which may be compounded with verb-stems and adjective-stems, and one that cannot be a verb. When not in combination, i.e., when standing alone, its stem must have a prefixed pronominal gender-sign, and commonly a final vocalic sound which generally undergoes transmutation when the stem is compounded with other elements

In the "Iroquois Book of Rites" (p. 120, Section 9) appears the sentence-word *tetyathrokuanekĕñ*. There it is faultily printed as written in the original manuscript, thus,— *thadetyatroghkwanekenh*,— and its common but metaphoric meaning, "Let thee and me smoke together," is also given. The initial *tha* is evidently the misspelled contracted form *tho* of the locative adverb *e'tho* ("there"), which is not a proclitic, and should not therefore be treated as such. The etymologic elements of this sentential compound are the following: *te* (meaning "two") qualifies the noun-stem; *ty* (for *ni* by regressive assimilation) is the prefix pronoun of the inclusive first person dual, meaning "thou and I;" *at* (for *a't*, sometimes the sign of verbal reflection) has here rather a possessive force, denoting "our" or "our own," and qualifies the noun-stem; *hrokua* (meaning "pipe," "a portion of tobacco") is the noun-stem; *nekĕñ* (signifying "to set or place, together or side by side") is the verb-stem, being in the exhortative mode. Therefore the compound means literally, "Let thee and me place together our own two pipe[s]," and metaphorically, "Let thee and me smoke together."

The following examples confirmative of the abstract nominal character of the stem *hrokua* are cited from the "Radices Verborum Iroquæorum" of Father Bruyas, as published by Dr. Shea. These sentential compounds, although recorded for more than a hundred and seventy-five years, show that when they were recorded, *hrokua* was used strictly as the stem of a generic noun, and in exact accordance with the genius of the language. The forms in parenthesis are in the lettering of Father Bruyas; and the others, in the writer's orthography, are severally lettered to express their orthoepy. The first of these citations is *kahrokuĕñta'o*^{n} for *kahrokuaĕñta'o*^{n} (*garokwentaon*), i.e., "One has finished smoking," but literally, "One has ceased from [his] pipe or tobacco." Its etymology is as follows: *ka*, "one" (a person); *hroku-* for *hrokua*, "pipe" or "tobacco;" *ĕñtă'*, "to stop," "end," "cease from," "finish;" and *o*^{n}, the sign of the perfect tense. This verb *ĕñtă'* is erroneously classed under "Accidents Verbaux," with the title "Du Consomptif," by Father Cuoq in his "Judgement Erroné" (p. 65). It is, however, a verb, and not a flexion. The next is *ronathrokuayĕñto*^{n}' (*atrokwajenton*), i.e., "They severally have their own pipes or tobacco," but literally, "They severally have laid down their own pipe[s] or tobacco." Its analysis is as follows: *ron* (meaning "they") is the plural masculine third person of the prefix pronoun of the anthropic gender; *at* (usually the sign of verbal reflexion) is here the mark of possession, meaning "(their) own;" *hrokua* (denoting "pipe" or "tobacco") is the noun-stem; *yĕñ* (signifying "to place" or "lay down") is the verb-stem, which in the perfect tense means "to have or possess;" *to*^{n} (denoting "severally" or "individually") is the distributive flexion; "'" (an apostrophe) is here the sign of the perfect tense, and represents a suddenly interrupted guttural sound. This peculiar sound, although of the first importance and of essential and indispensable use in Iroquoian etymology and phonology, has, with a single exception apart from the present writer, been overlooked and disregarded by the students past and present of the language of the Iroquois. The Rev. Asher Wright, who, until his death in 1875, was a missionary among the Senekas in the State of New York, refers to this significant sound in his Senekan "Spelling-Book." While speaking of the phonology of the language, he says, "This letter (*h*, *H*)[1] never precedes a vowel; following one, it should be spoken by giving the vowel an explosive force, and breaking it off suddenly, in such a manner as for the instant to stop the breath entirely. . . . This sound is very abundant in Seneca, and, used in conjunction with certain other modifications, the mode and tense of verbs, and various other circumstances, are denoted by it. Often, also, it forms the chief distinction between words of very dissimilar meaning. No one can read or write Seneca intelligibly who does not pay the strictest attention to this character." . . . These important remarks are equally pertinent to all the other dialects of the Iroquoian tongue, including the Tcerokian dialects.

The third citation is *ronathrokuakhaho*^{n}' (*atrokwaghahon*), i.e., "They severally are apart smoking," but literally, "They severally have their pipes apart." The pronominal and the nominal parts being the same as those explained in the last example, it will be needful here to speak only of the verb and its flexions. The verb-stem is *kha*, and means "to separate," "divide," or "have apart;" *ho*^{n} is here the distributive flexion, meaning "severally," "individually;" "'", previously explained, is the sign of the perfect tense. The last citation from Bruyas is *twathrokuanekĕñ* (*twatrokwanneken*), i.e., "Let you [plural] and me smoke together," and literally, "Let you [plural] and me place our own pipes together." The following is the analysis of this compound: *tw-* (signifying "ye and I") is the inclusive plural first person of the prefix pronoun; *at* (commonly the sign of verbal reflexion) means here "our," "our own;" *hrokua* is the noun-stem, denoting "pipe" and "a portion of tobacco;" *nekĕñ* (meaning "to set or place together or side by side") is the verb, being in the ex-

[1] These letters should have an oblique line through them.

hortative mode, which, as has been said, possesses no distinctive mode-sign.

These several examples of the compounding of the stem *hrokua* with different verbs furnish conclusive evidence that it is a noun-stem, and that it is never used as a verb: hence it cannot, of course, have an "indeterminate verbal" form *yehrokua'*, although Mr. Hale has been misled to believe it can have.

In the writer's article first above mentioned the conjectured "indeterminate verbal" form *yehrokua'* (Mr. Hale's *ierokwa*) was rendered "one smokes by which" by the writer, instead of the words "they who smoke," suggested by Mr. Hale.

Evidently overlooking the reasons for the correction, he says, "The indeterminate form, however, is constantly used with a plural signification." The writer's correction, however, was intended primarily to show that if *yehrokua'* were a verb, ending as it does in *kua'*, which with verbs is the instrumental sign, it would have an instrumental or causative meaning in addition to its assumed predicative meaning, "one smokes;" second, to emphasize the important fact that *ye*, its pronominal prefix, has not a relative meaning, expressed by "who" in Mr. Hale's rendering, for it is certain that in this language there is no pronominal prefix which has in itself both a nominative and a relative meaning, and also to show the writer's preference for rendering a singular pronoun by an equivalent of a like number Furthermore, the correction was intended to bring to view the all-important fact that since a sentence-word in the instrumental or causative mode predicates the means or instrument of an action or a state or condition of being, it may become the descriptive name of that means or instrument, and, lastly, it may become a generic noun through further development; and that it may not become a name of the same thing or things of which its nominative prefix pronoun is also a name, as implied in Mr. Hale's faulty translation and unfounded etymology of this conjectured verbal form. These are among the chief reasons why the writer objected to the derivation of the word "Iroquois" from the supposed verbal form *yehrokua'*.

Only a misconception of the grammatic and morphologic structure of the Iroquoian tongue could be the basis of the errors and linguistic fallacies to which Mr. Hale has given utterance in the following language. He says, "The manner in which Iroquois verbs are formed from nouns, and in turn yield nouns expressive of agency or condition, will be apparent in the inflections of the word *kanonsionni*, the well-known name of the Iroquois confederacy. It means literally 'the extended house,' from *kanonsa* ('house') and *ionni* ('to extend' or 'lengthen out'). Replacing the noun-forming prefix *ka* by the verb-forming prefixes, we have, in the third person, singular and plural, *ranonsionni* and *rotinonsionni*, literally 'he [who] extends the house,' and 'they [who] extend the house,' but understood to mean 'he is an Iroquois,' 'they are Iroquois;' or, as nouns, simply 'an Iroquois,' 'the [plural] Iroquois.'" This is a series of erroneous statements.

Now, a "noun-forming prefix" and "verb-forming prefixes" are unknown to this language. Mr. Hale's ascription of such a novel office to the prefix pronouns of this language is therefore pure fancy.

The very prefix *ka*, which he calls a "noun-forming prefix," has no such function, as it is a prefix pronoun; and the sole office performed by the prefix pronouns of this language is to express, more or less clearly, person, number, case, and, in third persons, gender and generally sex.

The pronoun *ka* cited above is used indifferently with verb-stems, adjective-stems, or with noun-stems; and yet it does not transform the verb-stems and the adjective-stems into noun stems, which it would most assuredly do had it a "noun-forming" function. It is a pronominal affix to the following and other verbs, — *kanoñhwe's*, "it loves, cherishes, [it];" *kăhnino^{n}s*, "it buys [it];" *kahraraks*, "it bores [it];" *kakĕ^n*, "it sees [it];" *karyŭs*, "it kills [it];" *kariks*, "it bites [it]," — and yet these verb-stems do not become noun-stems. This fact is conclusive evidence that the prefix pronoun *ka* has not a "noun-forming" office.

Moreover, as Mr. Hale substitutes the masculine prefix pronouns *ra* and *roti* (the latter erroneously for *rati*) for the prefix *ka*, they must be, therefore, two of the "verb-forming prefixes" mentioned by him. But with what has been said concerning the prefix pronoun *ka*, and the general purpose of the pronouns, it is only needful to add here that the pronouns *ra*, *rati*, and *roti*, mentioned above, are used indifferently with noun-stems, adjective-stems, and verb-stems; and yet the nominal and the adjective-stems do not become verb-stems, as they would if the prefixes *ra*, *rati*, and *roti* possessed "verb-forming" powers. The following examples confirm what has just been said, — rotĭ*niko$_n$ra'*, "their [masculine] mind;" ra*orihwa'*, "his matter, business;" roti*rihwa'*, "their [masculine] matter, business:" and the following with adjectives, — ra*hoñ'tci*, "he [is] black;" rati*hoñ'tci*, "they [are] black;" ra*naye*, "he [is] proud;" rati*naye*, "they [masculine] are proud;" ra*kowanĕñ*, "he [is] large;" rati*kowanĕñ*, "they [are] large."

These facts make it clear that Mr. Hale is wholly mistaken as to the nature and office of the prefix pronouns in this language.

Again, judging by his translations, it is evident that he employs the letters *imni* to express two very distinct forms of the verb-stem *yoñnĭ*, — the present of the indicative, and the perfect tense participle, — a distinction of which he appears to be unaware. The stem of the present may be accurately lettered thus, *yoñnĭ*; and that of the participial form thus, *yoñnĭ'*. In both, the final vowel ĭ is short, but in the latter case followed by the peculiar and important sound represented by "'" (an apostrophe).

Mr. Hale's rendering of his *ranonsionni* and *rotinonsionni* by "he [who] extends the house" and "they [who] extend the house," respectively, shows that he was unaware of the fact that the two prefixed pronouns were peculiar to different tenses, and that consequently they could not be rendered in the same tense, else he would have indicated this fact in his orthography and translations of the two forms cited; and his interpolation of the relative "who" in these translations is gratuitous and fanciful, for reasons already stated elsewhere in this article.

In Mr. Hale's orthography, the letters *nonsionni* express the compound stem of the sentence-word *kanonsionni*. The writer will represent this stem with the following letters diacritically marked; thus, *no^{n}syoñnĭ* for the present of the indicative, and *no^{n}syoñnĭ'* for the perfect tense participle of the same mode.

The forms *rano^{n}syoñnĭ* and *ratino^{n}syoñnĭ* may be respectively rendered, "he extends, is extending, the house," and "they [masculine] extend, are extending, the house;" but *rono^{n}syoñnĭ* and *rotino^{n}syoñnĭ*, by "it or he extends, is extending, his house," and "it extends, is extending, their [masculine] house." These forms are in the present indicative, but the change of signification wrought by the change of the forms of the prefixed pronouns is noteworthy. The forms *rano^{n}syoñnĭ'* and *ratino^{n}syoñnĭ'* may be respectively rendered "he-house-extended-[is]" and "they [masculine]-house-extended-[are]," and freely, "he is, they are, an extended-house;" *rono^{n}syoñnĭ'* and *rotino^{n}syoñnĭ'*, by "his-house-extended-[is]" and "their [masculine]-house extended-[is]," i.e., "his, their, house is extended." The last four sentential forms are participial, the substantive verb being commonly understood in the present tense of the discourse.

The participial sentential forms are expressive of a state or condition of being, and for this reason only can they convey the "idea" of "a man of the extended-house." For this reason it is imperative to distinguish carefully between these and the verbal sentential forms of the present of the indicative.

In addition to the foregoing corrections of Mr. Hale's errors as to the first principles of the language, it is necessary to add that the participial forms may be translated correctly only by the sentences "He is an Iroquois" and "They [masculine] are Iroquois," and not by the titular and cognominal words "an Iroquois" or "the Iroquois." Sentences are translated with complete and formal accuracy only by sentences. Each of the mooted verbal combinations forms a sentence, — a combination of parts of speech making together complete sense.

Mr. Hale's assertion, as explained by himself, that "the manner in which Iroquois verbs are formed from nouns, and in turn yield nouns expressive of agency or condition, will be apparent in the inflections of the word *kanonsionni*," is therefore at variance with the structural laws of the language.

Such faulty and inaccurate work must necessarily shake the confidence of scholars in the trustworthiness of the results of linguistic methods and theories such as those herein criticised.

To allow etymologies and methods of linguistic research such as those just criticised to pass unchallenged, and to leave them without pointing out the misconceptions upon which they are based and the fanciful reasonings wrought in their support, would be tantamount to accepting error and fancy for truth. Although it is proper to deprecate "wasting our time in minute verbal criticism of the work of our fellow-students," yet it is difficult to avoid seeing that it is imperative on scholars, in every department of science, to test the work of their fellow-investigators by rigid and discriminating analysis; and, if they fail to perform this their most evident duty, the student unfamiliar with the subject-matter will be left to assume that faulty and inaccurate work rests on a foundation of fact, and will be more than likely, especially in the beginning of his career, to make it the basis of further research, and, of course, new error.

In conclusion, it should be borne in mind that those who will not, personally and without preconceptions, study this language, and who appear to be unable to see any thing on which the light of their theories does not fall, and who do not "profess to distinguish the niceties of Indian pronunciation," although these so-called nice distinctions are, in fact, the marks and indices of essential grammatic and morphologic elements, must not hope to accomplish, in the domain of Iroquoian etymology and morphology, trustworthy and accurate work. J. N. B. Hewitt.

Washington, D.C., Jan. 28.

A Double Motion of Clouds.

It is generally accepted that our storms and high areas drift in the upper currents of the atmosphere, and that the direction of motion of clouds will give us important information as to the direction of the former. The present writer has devoted most careful attention to this subject for more than three years and a half, and has found that while clouds, especially the higher forms, have a general tendency to move in the same direction as storms, that is, from west to east, yet they are a very poor guide to follow in special instances, and they fail especially at times when such assistance is the most needed. This may be in part due to the fact that the upper clouds cannot be seen in the neighborhood of storms, and in part to the difficulty of estimating the height of clouds. In the case of high areas, the clouds frequently are less than three tenths, and, if so, their direction does not appear on the maps. Much time has been spent in watching the motion of clouds at all hours of the day, and it is possible that a very important factor in their motion has been omitted.

Every one has remarked the beautiful cirrus stripes which are often seen traversing the sky, usually from south-west to north-east. I have gleaned the following statements from various authorities. Van Bibber speaks of them as resembling trees on the streets. This probably refers to the narrowing effect due to perspective. He also says, "These formations were given by Humboldt the ill-suited name 'polar bands.'" Kaemtz says, "In Germany these clouds are known under the name of 'wind-trees' (*Windsbaüme*)." In a footnote Martius says, "The tendency which the cirri have to arrange themselves in parallel bands is remarkable; and it proves that the cause which directs their filaments to one azimuth rather than another, instead of being merely local and accidental, extends to great distances. By a well-known law of perspective, parallel bands ought to appear diverging from one point of the horizon, and converging at the point of the horizon diametrically opposite. The phenomenon occurs more frequently in Lapland than in the temperate zone. Humboldt found that at the equator the bands were generally directed from north to south. The cause, which thus arranges the great axes of these clouds according to parallel lines, is still unknown. Forster was the first who made the very just remark that these clouds almost always travel along a parallel to their great axis, which greatly contributes to render them apparently motionless. Many meteorologists (Howard, Forster, Peltier) seem to believe that the cirri serve as conductors between two distant foci of electricity, of opposite names, which tend to combine, and that the flexibility of the conducting clouds terminates in the rectilinear form, which is necessitated by the condition of the shortest path from one focus to the other." Loomis says, "The direction of the parallel bands generally coincides with that of the wind, and it has been suspected that these lines of cloud serve as conductors of currents of electricity, and this may be the agent which causes the clouds to assume such artificial forms." A more guarded statement than this it would be difficult to put forth.

Abercromby of England has probably given more attention to these motions than any one else. He speaks of the appearance as being known as "Noah's Ark" in England. "Frequently we see the curious spectacle of a long stripe of cloud moving either broadside on or obliquely to its length. As we must suppose that a stripe always sails with the wind in which it floats, we have to find out how a stripe can be formed which moves across its length. At first sight, this is one of the most puzzling phases of cloud-motion. These formations of clouds are, however, exactly analogous to the smoke left by a steamer running before the wind. If she runs faster than the wind, her smoke trails behind; but if the wind blows faster than she steams, then the smoke is blown forwards in front of her." He then shows that if the direction of the steamer is not that of the wind, the line of smoke will form an angle with the former. "Now, this is exactly what happens in nature. The ascensional column of moist air, which will eventually form a cumulus, starts from near the earth's surface, drifting with the wind which blows there; when it arrives at a certain height, it meets an upper current moving in a different direction to that on the surface, and probably begins to condense there. The stripe which would be formed under these circumstances would behave exactly like the smoke of a steamer; that is to say, it would lie obliquely to the wind which was driving it." Any one who is desirous of learning more of these views and observations will find them in "Weather," pp. 84–91.

I have made these quotations very freely from all the authorities I have at hand, fourteen in all, as it seems to me the subject is of the highest importance, and has been very much neglected up to the present. My own observations are as follows. In a perfectly clear sky these clouds will come up from the south-west, and move gradually to the north-east. When the stripes are over head, a double motion is often very easily recognized. One of these may be quite rapid, and I have often noticed that it coincided with the north-west wind or at right angles to the stripe. From observations on Mount Washington and of cirrus in Europe, this velocity may be a hundred or even a hundred and fifty miles per hour. At the same time, it is not a difficult matter to recognize a second motion directly in the line of the stripe. This motion may be a third or a fourth that of the other, and sometimes it is very much slower. Observation indicates that this second motion is often, if not always, in the direction of the storm which is then near the station. If this can be incontestably established, it will be seen what an extraordinary advance will be made in our studies. We shall see, then, that this marked movement of the upper current which first attracts our attention, and so often masks the second motion, is, after all, the less important as relates to the movement of the storm. The greatest interest centres about the cause of this second motion. It is evident that these stripes do not form conductors of electricity, because their motion occurs in lines where there are no clouds. Is it not probable that this current exists in the first place? During the last maximum of sunspots, I observed very carefully an electric light playing in cirrus stripes in my zenith, and mentioned the fact to others. I have also observed a motion in auroral beams which was not so very different from this second motion of cirrus stripes. The suggestion made by Mr. Abercromby, that this second motion takes its origin in a lower cloud, which keeps its direction after rising to a higher level, cannot be accepted at all. Such a motion as that would be very quickly brought to rest instead of being in existence for a hundred miles or more. Moreover, the origin of these beautiful and regular cirri cannot possibly be in irregular masses of cumulus rising heterogeneously from a lower to a higher level.

It seems to me that there are needed just now a careful series

of observations, showing (1) the extent of this second motion on different sides of a storm or high area, (2) the relation of the direction of this second motion to that of the storm or high area, (3) the cause of this motion, etc. At the same time, the facts and views here presented show that this subject is of the greatest interest, and may be of the highest importance.

H. A. HAZEN.

Washington, D.C., April 11.

BOOK-REVIEWS.

Die Mutter bei den Völkern des Arischen Stammes. By MICHAEL VON ZMIGRODZKI. Munich, 1886.

La Question de la Femme c'est la Question de la Mère. By MICHAEL VON ZMIGRODZKI. Paris, 1890.

Zur Geschichte der Suastika. By MICHAEL VON ZMIGRODZKI. Munich, 1890.

THE application of the facts drawn from ethnology and archæology to the practical social questions of the day is one of the new and valuable acquisitions of science. Being new, one may reasonably expect that some time will elapse before it is employed with the best advantage; but meanwhile all honest and earnest efforts in this direction should be respectfully considered.

One such is before us in these works of the Polish writer Zmigrodzki. Appreciating that the position of woman in the social organization is the test of its excellence, he reviews the growth of the Aryan nations, both anthropologically and historically, and seeks to draw from his material the wisest rules for the place of woman in the present and the future of European and general civilization.

Without discussing the mass of learning on which he founds his conclusions, it is worth while stating what these are. He first urges that both sexes have naturally, and should be guaranteed legally, absolutely equal civil rights, equal opportunities for gaining an independent livelihood, equal wages, equal admission to all professions, avocations, and State employments. No marriage should be allowed until the woman is twenty and the man twenty-five years of age. The ceremony of marriage should be religious only, and the bond should be indissoluble, divorce for any ground being inadmissible. Illegitimate children should inherit equally with legitimate, and prostitutes should be condemned to forced labor for two years. During pregnancy, a woman who is earning salary or wages should have her income continued without labor on her part.

It is evident how impracticable and even grotesque are some of these recommendations; but, as they are founded on a supposed logical development of the theory of the equality of the sexes, they are interesting as illustrating the inherent difficulties in the way of this theory. There is also an evident desire on the part of the author to square his conclusions as much as possible with the precepts of the Roman Church, which obviously hampers his freedom.

His pamphlet on the Svastika is an endeavor to prove that this mysterious symbol is strictly Aryan in character, and is connected with the *Mutterrecht*. He seems to forget that his extreme devotion to the Aryan history and culture is often in rather ludicrous contrast to his obeisances to the Semites, Moses, Luke, Peter, etc., whom he frequently quotes, and whose religion he has adopted, as distilled through Roman alembics.

The American Race: A Linguistic Classification and Ethnographic Description of the Native Tribes of North and South America. By DANIEL G. BRINTON, A.M., M.D. New York, N. D. C. Hodges. 8°. $2.

FOLLOWING close upon his "Races and Peoples," which appeared last year, the present volume is a further evidence, if such were needed, of Dr. Brinton's untiring devotion to linguistic and ethnographical studies. "The American Race" is the first attempt to classify systematically the peoples of the continent of America, who are its aborigines, upon a basis of language, — a basis of classification which would seem to be more safe and more useful in America than in any other quarter of the globe. In his use of language as a classifier of peoples, the author attaches primary importance to grammatical construction, although he admits that our knowledge of the grammar of some American peoples is very meagre.

In his introductory remarks, Dr. Brinton reviews the general aspects of American anthropology, touching upon the various theories advanced regarding the peopling of the New World, the age of man in America, the glacial epoch, racial traits and characteristics, arts, religion, languages. His conclusions are that there is an "American race," and that primitive American man in all probability migrated by way of the North Atlantic land-bridge from the Eurafrican continent.

He divides the American race into five great groups: I. The North Atlantic group; II. The North Pacific group; III. The Central group; IV. The South Pacific group; V. The South Atlantic group.

As regards "temperament, culture, and physical traits," Dr. Brinton considers that there is a "distinct resemblance" between the North Atlantic and the South Atlantic groups, and that there is "an equally distinct contrast" between these and the Pacific groups.

Of the main portion of the book, pp. 59–164 are occupied with the discussion of the peoples of North and Central America; pp. 165–332, with those of South America. The "Linguistic Appendix" (pp. 333–364) is invaluable, containing comparatives, vocabularies (of sixteen words and the numerals from one to five) in no fewer than one hundred and twenty languages and dialects of Mexico, Central and South America. Dr. Brinton's characteristic wealth of suggestion appears throughout the book, particularly in the portions which deal with the peoples of Central and South America, to whom special attention appears to have been given.

In the North Atlantic group are classed (1) the Eskimo, who formerly ranged much farther south, and whose primitive home was in the Hudson Bay region; (2) the isolated Beothuks of Newfoundland, who appear to have no marked affinities, as far as language is concerned, with any other people; (3) the wide-spread Athapascans, who are found over the wide territory from the Arctic Ocean to the frontiers of Mexico, and from Hudson Bay to the shores of the Pacific; (4) the Algonkins, who inhabited the North Atlantic littoral and the lake region of Canada; (5) the Iroquois, an inland people, with whom are affiliated in language the Cherokees; (6) the Chahta-Muskokis; (7) diverse tribes, such as the Catawbas, Yuches, Timucuas, etc., whom the author believes to be the remnants of the peoples who occupied the region before the immigration of the Muskokis from the North and West (it would appear, however, that to these Allophyllian tribes the Catawbas, at least, no longer belong, as they have distinct affinities with the Siouan stock); (8) Pawnees or Caddoes; (9) the important Dakotan or Siouan stock; (10) Kioways.

The North Pacific group comprises the tribes of the North-west coast and California, besides the Yumas and Pueblo peoples. There is room for much research within this group of tribes; and the recent investigations of careful observers like Dr. Boas have cleared up not a few troublesome questions in the ethnology of the Pacific region.

Under the Central group Dr. Brinton classes the Uto-Aztecan (comprising the Shoshonian, Sonorian, and Nuhuatl); the various tribes of Mexico and Central America, such as the Otomis, Zapotecs, Chapanec, Chontals, Mayas, Lencas, Musquitos, etc.

Here for the first time we learn the affinities of some of the Central American languages; such as the Rama, for example.

The chapters of the book relating to South America are more detailed, and the reader will find in them an excellent guide with which to thread the mazes of South American tribal nomenclature.

The first great division of this half of the continent is the South Pacific group, which embraces (1) the tribes of the Columbian region, and (2) the tribes of the Peruvian region The principal Columbian peoples are the Cunas, Changuinas, Chocos, and others of the Isthmus of Panama and the adjacent coast, the well-known Chibchas, the Paniquitas and Paezes (identified as one by Dr. Brinton), and the various tribes of the southern states of Cauca and Antioquia. In this region the author determines the Cayapa and Colorado to be dialects of the same stock.

The Peruvian sub-group comprises the Kechuas and Aymaras, Puquinas, Yuncas, Atacameños, and Changos. The exact affiliation of these languages has not yet been made out. Dr. Brinton thinks that ultimately the Aymara will be shown to be either a dialect of Kechua, or a jargon made up of Kechua and other stocks.

The South Atlantic group is a very extensive one, including the innumerable tribes of the Amazonian and Pampean regions, who are spread over the territory from the Orinoco to Tierra del Fuego. The principal subdivisions of the Amazonian sub-group are the Tupis (with some forty dialects); the Tapuyas (with nearly as many); the Arawaks (more diverse even than the Tupis); the Caribs (with numerous dialects); the Corvados, Carajas, etc.; the Carib and Arawak tribes of the Orinoco basin; the numerous tribes of the basin of the Upper Amazon (Zaparos, Jivaros, etc.); and the Chiquitos, Mosatenas, Cayubabas, and other tribes of the Bolivian Highlands. The author attaches the Paiconoca and Saraveca to the Arawak stock, and thinks that Carajas have Tapuya affinities, while the Yahuas and Pebas appear to be somewhat related.

In the subdivision of the Pampean region Dr. Brinton has arranged the Guaycurus, Lules, Payaguas, and other peoples of the Grand Chaco; the Pampeans, Araucanians, and Chonos; the Patagonians and Puegians. The modern Vilela the author is inclined to consider the present representative of the Lules of whom Father Machoni wrote in 1732. The affinities of the coast tribes of Patagonia are uncertain. The relations of the Patagonians (Chonek) still remain to be settled. Among the Fuegians there appear to be at least three distinct linguistic stocks, — the Alikuluf, the Ona, and the Yahgan.

Taken on the whole, the present volume is beyond doubt the best introduction to American ethnology that we possess, and the reader will learn from it how much American linguistic and ethnographic science has advanced of recent years.

AMONG THE PUBLISHERS.

THE editor of the "Letters of Dorothy Osborne," Mr. Edward Abbott Parry, has written a life of Charles Macklin for Mr. William Archer's series of Eminent Actors, and Longmans, Green, & Co. published it here last week.

— "Miracles and Medicine" is the subject which Dr. Andrew D. White will take up next in his Warfare of Science Papers in *The Popular Science Monthly*. The May number will contain the first part of this chapter, telling how tales of miraculous cures arose and grew in the middle ages, and how the early progress of medical science was hampered by the jealousy of relic-pedlers and theological oracles. The Duke of Argyll's essay, "Professor Huxley on the War-Path," will be concluded in the same number. The duke appeals to geology for evidence of an inundation such

as is described in the story of Noah's Flood, and to archæology for support of the general truth of Bible history. The process of making artificial ice, and the arrangement of cold storage warehouses, will be described in an illustrated article on "Ice-Making and Machine Refrigeration," by Frederik A. Fernald. This industry, which has grown to importance within the last few years, is an interesting example of the application of science in supplying the wants of daily life. Some games of the Zuñi will be described by John G. Owens, with illustrations. The Zuñis are a playful race, and have a large number of sports, some of which are exciting. A possible solution of the problem of moral education is suggested in a paper entitled "An Experiment in Moral Training," which will be contributed by Dr. Mary V. Lee. The article describes a conversation between a teacher and his pupils in regard to removing two unruly members from the class, which tends to show that children may be led to govern themselves if rightly guided. Among the shorter articles will be one on the "Evolution of Patent Medicine," by Lee J. Vance, in which human weakness for mysterious cures is traced from the days of saintly relics down to the much-advertising "medicine-men" of our own time.

— The May *Cosmopolitan* will contain an article on the Silver Camp of Colorado, Leadville, by Theodore Van Wagenen. The article accurately describes the camp and its environs, and is accompanied by a series of photographs of miners at work, taken chiefly in the "Iron Silver" Mine.

— Francis W. Cragin, S.B., professor of geology and zoölogy in Washburn College, Topeka, Kan., announces for publication in a few months "A Geology and Physical Geography of Kansas," — an illustrated handbook of Kansas, educational in its relation to pure science, practical in its relation to the development of the natural resources of the State,— for the use of students, teachers, travellers, farmers, investors, and general readers.

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SCIENCE

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PROTECTION FROM LIGHTNING.

PROSPECTUS.

47 LAFAYETTE PLACE, NEW YORK, March 9, 1891.

It is proposed by the owners of letters patent dated Dec. 16, 1890, on an improved method for protecting buildings from lightning, etc., to organize a company for the handling of said patent and all improvements; and subscriptions are requested on the following terms and conditions:—

1. A company is to be organized with a capitalization of $10,000, in 1,000 shares of $10 each, fully paid in at par, the company to be organized in such State as the subscribers may determine by vote when all shares have been subscribed for, and with a charter to contain a provision that the amount of capitalization shall never be increased.

2. This $10,000 is to be used as working capital; and the object of the company wil simply be to place licenses with responsible persons, corporations, or sub-companies, al such rates of royalty as may be agreed upon by a majority vote.

3. In lieu of any stock or cash payment to the inventor for his patent, the inventor will give said company the exclusive control of his said inventions in consideration of the payment to him by said company of one-third of the gross royalty receipts.

The officers of the company shall be elected by a majority vote of the stockholders without reserve. No stock shall be given to anybody for services or any thing else except actual cash payment at par into the treasury.

No subscriptions will be binding until the full number of 1,000 shares has been subscribed for.

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CALENDAR OF SOCIETIES.

New England Meteorological Society.

April 18.—J. Warren Smith, The methods of the United States Signal Service (with exhibition of charts furnished by the chief signal-officer); W. M. Davis, Weather Maps in Foreign Countries (with exhibition of samples); A. Lawrence Rotch and N. Helme, Local Predictions; and H. H. Clayton, Long-Range Predictions.

American Academy of Political and Social Science.

April 17.—Emory R. Johnson, The River and Harbor Bills.

Biological Society, Washington.

April 18.—H. E. Van Deman, The Recent Introduction of Date-Palms; B. T. Galloway, Recent Observations on a Bacterial Disease of Oaks; L. F. Ward, Some Florida Plants; Cooper Curtice, Practical Value of Investigating Parasites of Live-Stock; Theo. Holm, Abnormal Flowers in Glyceria.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED—A position in some College, Normal School or Academy to teach Biology, Physiology, Comparative Anatomy, Histology, Embryology or Botany. A graduate of the University of Wisconsin. Have had four years' experience as a teacher. Address "BIOLOGIST," care SCIENCE.

WANTED.—All of Vol. I. of *Journal of Analytical Chemistry*, published at Easton, Penn. State price and condition. SCIENCE BOOK AGENCY, 47 Lafayette Place, New York.

WANTED—A position in a Summer School of Gymnastics to teach any one or more of the following named physical exercises, viz.: Fencing (to ladies especially), Sparring, Club Swinging, Wands, Chest Weights and Free Movements. Am prepared to offer very favorable terms to any school desiring such work. WILLIAM FINDLAY, Proprietor of Phila. Inst. of Phys. Cult., 1009 Arch Street, Philadelphia, Pa.

A HARVARD M A., especially interested in Natural History, would like to learn of some outdoor occupation for the summer. Remuneration a secondary object. SUMMER, *Science* Office.

A CHEMIST, taking P. G. work in the Scientific Department of one of our best colleges, would like to negotiate for some industrial position, where his knowledge would be of avail. Can furnish best of references. R. S. W., Box 691, Amherst, Mass.

WANTED—A position to teach Electrical Engineering by a student from leading English and French and U. S. science schools, or would accept position as Consulting Electrical Engineer, Electrician, etc. Very highest testimonials London & Hartford Publishing Co., N. Y. (International Press Department.)

WANTED.—A young man in college would like a position during the summer of 1891 in some scientific work, particularly Orinthology, either as an instructor or tutor, or in making collections or accompanying some scientific expedition. Can give good references. Address HUBERT L. CLARK, Amherst, Mass.

WANTED.—A young man who has been teaching in a first-class High School desires a position in a similar institution. Is competent to teach Mathematics, Latin, Book-keeping, and the English branches. Can give highest references Address H. W. MARTHENS, 6208 Broad St., Pittsburgh, Pa.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

Will exchange a new Thomson reflecting astatic galvanometer, about 6,000 ohms, made by Clark, Muirhead & Co., London, and costing £30, with 1-9, 1-99, 1-999, shunts, lampand scale, for a Weston voltmeter and ammeter, or arge Wheatstone bridge, dial pattern, or a portable testing outfit. Address G. A., *Science* Office, 47 Lafayette Place, New York.

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

I have a good supply of Eastern Coleoptera which I wish to exchange for species not in my collection. Melandryidae and Oedemeridae especially desired. Joe C. Thompson, Rosebank P. O., Box 73, S. I.

SCIENCE

NEW YORK, APRIL 24, 1891.

GAME-PRESERVATION IN GERMANY.[1]

OBSERVANT Americans, travelling by rail through Germany during the late summer or autumn months, are often astonished by the abundance of hares, partridges, and pheasants, which are to be seen in the fields and thickets along the railways, or by roe-buck — from two to a dozen or more together — feeding in pastures and meadows, and scurrying into the adjacent woods on approach of the train. This surprise is usually augmented when, at some country station, the traveller sees a party of sportsmen returning to town with the proceeds of a day's shooting. Remembering the denuded condition of the older and more thickly settled portions of our own country in all that respects field and woodland game, the impression is apt to come home to the transatlantic tourist that in this respect, at least, the Germans manage better than we have done. In fish-culture and the skilful breeding of many kinds of animals, the Americans are unsurpassed, if equalled, by any people of Europe; but, in making marketable game a plentiful product of fields that have been cultivated since many centuries before America was discovered, the Germans have, it would seem, set an example which we may study with interest, if not profit.

It is proposed in the present report to consider the German system of game protection and management from a purely economic standpoint. Aside from all consideration of shooting as a fascinating, healthful sport for men who are ordinarily confined to the wear and fatigue of city life, there is the practical question whether the growth of wild game may not, under proper conditions, be made to add in America, as it does so largely in Europe, to the annual cash product of fields and woodlands, even in the most thickly settled States and in the vicinity of large cities.

It was but natural that a people busy with the task of clearing and settling a country so vast as ours should, until within recent years, have regarded game birds and animals as part of the spontaneous product of the land, the property of whoever might take the trouble to pursue and kill them. Not within many centuries has any such easy-going indifference on that subject prevailed in these older nations of Europe. From the days when the game belonged to the crown, and hunting was the exclusive privilege of the king and the nobility, game birds and animals have been recognized as property not less tangible and defensible than domestic poultry or cattle.

With the imperial preserves of Germany and the vast estates of the wealthier aristocracy, where stags and pheasants are reared and tended by liveried game-keepers for wholesale slaughter on princely hunting-days, the present report has, for obvious reasons, no concern. All that belongs to a social and political condition so remote from our own as to divest it of all practical interest in this connection. But the imperial and grand ducal preserves cover but a small proportion of German territory. The vast bulk of it is possessed by individual farmers and communes, and is leased, so far as shooting privileges are concerned, to individuals or small clubs of professional and business men in the neighboring towns and cities for an annual rental. which amounts in the aggregate to many millions of marks, and constitutes one of the important revenues of the agricultural class. In no respect are the provincial governments of Germany more jealous of national interference than in regard to their game-laws. Prussia, Bavaria, Hesse, Würtemburg, and Baden have each their separate code for the protection of game and the regulation of shooting privileges; but, as it will be impossible to consider them all within reasonable space, we may fairly select as an example the code of Prussia, which is as fair and intelligently framed as any, and will serve to illustrate the system which has proved so successful and advantageous in this country.

One of the important provisions of the Prussian code is that which permits any proprietor of landed property to kill game at proper seasons in any part of his premises that may be enclosed by a fence or wall, but which denies him this privilege on any piece of unenclosed land which is less than two hundred acres in extent. In the latter case the game on the farmer's land reverts to the care of the commune in which he lives, which rents the shooting privileges of all such territory within its limits, crediting to each farmer his due share of the aggregate rental, proportionate to the area of his land.

As nearly all farming-lands in Germany are owned in small tracts by peasant farmers who live in villages, and as such lands are rarely or never enclosed by any semblance of hedge or fence, it follows that most field-shooting is leased by the communal authorities at prices which vary from twenty to seventy-five cents per acre annually, thus adding an additional crop, so to speak, to the yearly product of the ground. These shooting privileges are leased usually for terms of six, nine, or twelve years. Competition is by auction at the office of the communal burgomaster, and the lease goes to the highest bidder who can furnish satisfactory guaranties as to financial responsibility. The lessee then becomes responsible, not only for the proper care of the game in the fields and woods covered by his lease, but also for whatever damage the game may inflict upon growing crops. Should the hares injure the beets and turnips, or the deer from the adjacent forest trespass upon the wheat or rye fields, the farmer summons the two communal assessors appointed for that purpose, who examine the premises, and estimate the amount of damage which the lessee of the shooting is required to pay. If he finds the tax excessive, he may nominate a third member of the board, and call for a re-appraisement of the damage. The lessee also employs a local game-keeper, who earns a yearly salary ranging from two hundred dollars to three hundred dollars, and whose business it is to look after the game, kill foxes, hawks, and other carnivorous creatures, and prevent poaching.

Nothing could better illustrate the universal respect for the rights of property in this country and the absence of that lawless, predatory spirit which pervades some less strictly governed communities, than the entire immunity from irregular depredations which is secured to partridges, pheasants,

[1] Report by Consul-General Mason of Frankfort, dated Jan. 8, 1891.

hares, rabbits, and other small game, even in the immediate neighborhood of populous German villages. The peasant farmer is satisfied with a system which secures to him a full cash value for all the game which his land may produce, as well as prompt payment for whatever damage the same may inflict upon his crops, and at the same time protects his fields from trespass by unauthorized persons or at seasons when the grain and grass might be injured thereby, for the game-laws carefully prohibit field-shooting until such crops are gathered.

An important feature of the protective system is the law which forbids any person from hunting or using a gun unless he is provided with the legal *Jagdpass*, or license. This license is issued by the local magistrate in each district to applicants of good standing, who must be not less than eighteen years of age, and, if under twenty-one years, must be vouched for by some responsible person. The pass is for one year, costs from seventy-five cents to three dollars, according to the varying regulations of the different provinces, and bears on its reverse side a checkered design showing the open and close months of the year for each kind of game. To be found outside of one's own premises with a rifle or fowling-piece and without a *Jagdpass* involves the confiscation of gun and accoutrements. This arrangement effectually eliminates the professional poacher and the predatory small-boy with the cheap shot-gun, who have been so destructive to singing-birds, as well as to furred and feathered game, in some other countries.

The game birds and animals of Germany include principally the stag, the fallow-deer and roe-deer, hares and rabbits, the capercailzie (or *Auerhahn*), pheasants, partridges, snipe, woodcock, wild ducks and swans, and several other varieties of birds, not to speak of fish-otters, foxes, and badgers, which are killed for their fur, or because they are destructive to fish and smaller game.

Keeping still in view the economic aspects of the subject, the practical question would be, which of these varieties might be most easily transplanted to the thickly settled portions of the United States, and grown there under conditions similar to those which exist in Germany. The climate of this country does not differ essentially from that of the Northern and Middle States of our Republic. With the exception that the proportion of woodland to open fields is larger with us than here, and that the American farmer keeps his land enclosed by fences, and lives on it instead of in a neighboring village, the principal conditions are nearly similar. The proportion of pasture and meadow to ploughed land is greater in most American districts than in Germany, but this would be to the advantage of the game rather than otherwise. In most States of the Union the laws distinctly recognize the right of the land-owner to the game birds and animals on his property, and enable him to defend that right against trespass. There would seem to be no reason why at least four of the species which are now grown so abundantly for sport and profit in Germany should not be at least equally successful in almost any part of the United States. These are the pheasant, the gray partridge, the hare, and the roe-deer, all of which live and thrive in proximity to man, and may be easily transferred to any locality suitable to their existence.

The gray partridge (*Rebhuhn*) of northern Europe is in size about midway between the quail and prairie-chicken of the United States, the former of which he strongly resembles in appearance and disposition. Although less beautiful than the red-legged partridge of southern Europe, he is not less "gamy" in the field or delicious on the table, his flesh resembling strongly that of our native quail. This species lives in the open fields and meadows of Germany, even close to the villages and farmhouses, and subsists at all times upon food precisely similar to that of the American quail and prairie-chicken. The female lays in May or early June from sixteen to twenty eggs, and, if foxes, weasels, or cold, protracted rains destroy her young brood, she makes another effort and brings forth her second hatching in July. The partridge-shooting season begins in Prussia on the 1st of September, by which time the young birds, except those of the second hatchings above noted, are well feathered, strong on the wing, and nearly full grown. Each brood forms a covey, and, like the prairie-chicken, they are at first tame and comparatively easy shooting, but with experience and the advancing season they become wilder and stronger; so that, although they are always "game," and lie well to a dog, particularly when approached from leeward, they are in later October and November sufficiently difficult to satisfy the most exacting sportsman. Partridges sell in the market at from fifty to seventy-five cents each, and, although killed in immense numbers, are always in demand. It is no unusual thing in this region to kill during a season two or three hundred birds on a farm not exceeding a hundred and fifty acres in extent; and there are several preserves in the open fields along the Rhine, between Mayence and Mannheim, where the average annual score exceeds a thousand.

It is, of course, quite at variance with American or English ideas for a sportsman to sell his game or consider in any way its market value, but in Germany no such squeamishness prevails. The product of each day's hunt, except what the master wants for his own use or chooses to present to friends, goes to the game-dealer, who has a standing contract with the sportsman to take his entire product at prices agreed upon in advance, and which are rigidly adhered to.

Until within a few years most sportsmen who leased shootings in this part of Germany could pay their rent and hire of gamekeeper, and even save a profit, from the proceeds of their game. This enabled many men of limited means to lease lands which would have been quite beyond the reach of their unaided private incomes, and thus practically the whole territory — woods, field, marsh, and mountain — was then, as now, leased for shooting purposes. But, with the rapid increase of wealth and the growth of the class of men able to afford the luxury of hunting, the competition for the best grounds has become so sharp that the rental has advanced enormously within a short period, so that comparatively few shooting leases are now self-supporting; that is, paying by sales of game the cost of rent, game-keeper, and damage by game to growing crops. Many shooting privileges in this region which were leased at auction during the past year have brought three times the rental of the previous lease made six years ago, and some communes now pay their local and national taxes from the revenues thus easily obtained. When it is considered how burdensome taxation has become to the German peasantry, the advantage of being able to pay this obligation in hares, partridges, and pheasants grown spontaneously on their lands will be at once apparent.

The pheasant of Germany is identical with that of England, France, and Austria, and is an exotic in Europe, having been brought many centuries ago from its native haunts in the Himalayan districts of India, by way of Asia Minor, into European Turkey, Austria, and particularly Bohemia, where it is now found wild in immense numbers. The

pheasant is a showy bird, of moderate merit for the table, except as an ornament, but nevertheless much esteemed for its beauty and for the easy, comfortable shooting that it affords. Pheasants are easily bred in this region from birds or eggs obtained from Bohemia, where the females cost from one dollar and seventy-five cents to two dollars each, the cocks, in the proportion of one to eight or ten hens, costing somewhat less.

Any person who has a few acres of thick wood with underbrush or open thicket sufficiently tall to furnish good cover has the necessary conditions for growing pheasants, which subsist on wild berries, buds, and the grain that they pick up in the adjoining fields. During hard winters, when the snows lie long and deep on the ground, careful sportsmen keep their pheasants within limits by feeding them grain; but there is in this part of Germany, so far as can be learned, none of that wholesale growing of pheasants in parks like chickens, that is so common and so costly on the great manorial estates of England.

The cock pheasant may be lawfully shot in Prussia during the whole year, except June, July, and August; the female, only from the 1st of September until the end of January. In most preserves the hen pheasants are rarely or never killed unless the stock becomes too numerous, which it may easily do unless the birds are preyed upon by foxes, hawks, and weasels, which are the persistent enemies of game in most parts of Germany. For this reason foxes, cats, and even stray dogs found at large upon land rented for shooting purposes, may be, and usually are, killed at sight. Aside from its natural enemies, the pheasant is a prosperous and prolific bird, and there would seem to be no reason why it should not thrive abundantly in almost every part of the United States. Birds and eggs for breeding purposes may be obtained in almost any quantity from dealers in Bohemia; but, as the demand is considerable from France, England, and western Germany, it is often requisite to give the order some weeks in advance of the laying season, which is in April and May.

The roe-deer is the smallest and most nearly domesticated of the three species of deer which inhabit Germany. It is likewise the most beautiful, and its flesh is the daintiest venison known to the epicure. In color, form, grace, and fleetness it resembles more nearly the antelope than other species of deer. It lives abundantly throughout the forests of central Europe, but prefers thickets of underbrush in the vicinity of open fields and meadows to the darker and denser woods which form the haunts of the stag and fallow deer. It is this tractable, half-domesticated disposition, its willingness to live in close proximity to the homes of men, that makes the roe-deer the valuable game animal that it is. It is no unusual circumstance to find from six to a dozen of these shy, graceful creatures living in a piece of woodland less than thirty acres in extent, and they are so abundant in this region that hunting parties frequently kill in a single day within ten miles of Frankfort anywhere from ten to forty of them. The roe-buck may be killed throughout the year, except during March and April; but the doe is protected by law ten months out of twelve, and may be shot only from the 15th of October to the 15th of December. The buck sheds his horns in December, and from that time until May looks so much like a doe that he is comparatively safe from sportsmen; but in the early summer he is again in season, and until September, when the stag and the partridge shooting begins, he has the hunters practically to himself. Roe-deer which live in the neighborhood of cultivated fields often inflict damage upon the growing wheat and rye; but this the thrifty peasant takes immediate note of, and, under the law already noted, assesses the damage upon the lessee of the shooting title. For this reason some of the best hunting leases command but a small rental, and I know of one instance in which a sportsman pays only 150 marks ($35.70) per annum for the rent of nearly a thousand acres, but distributes each year from $1,000 to $1,200 among the neighboring peasants for the damage done to their crops by his hares and deer. This occurs generally in districts where the proportion of wooded land to arable fields is but small; but the law which holds the game proprietor responsible for its depredations is an eminently just one, and takes from the farmer all temptation to destroy the game in self defence.

But the plain, reliable, every-day game of the average German sportsman is the hare. It resembles in appearance the brown American rabbit, but is much larger, and its flesh is decidedly superior; moreover, the hare, unlike the rabbit, never burrows, but lives wholly above ground, inhabiting the bleak fields in winter, with no other lair or shelter than a small open hollow scooped out beside a protecting clod or stone. More rarely the hare inhabits thickets and small woodlands adjacent to farms, but in deep, dark woods he is seldom found, and never in any great numbers. But in the open fields of southern and western Germany the hare swarms in such profusion as to form one of the definite products of the land. Although not entitled to high rank as game, either for the table or the sportsman, the hare is a coveted luxury to the poor and middle classes, and in some markets, notably that of Paris, is always in demand. At the same time it offers to the sportsmen a pot shot sufficiently attractive to amuse the most competent, and not so difficult as to discourage the inexperienced, gunner.

The mother-hare bears annually two, sometimes three, litters of from eight to a dozen leverets, which, although decimated by cold, wet weather, and preyed upon by foxes, hawks, and other enemies, still make a brave struggle for life; so that by September, when the shooting season begins, they are as plentiful as field-mice. Except for the few that are shot during the partridge-hunting, hares are not killed to any great extent until December, when the great *battues*, or drive hunts, are made, which supply the winter market. Although much less destructive to gardens and young trees than our rabbit, the hare is so prolific that, unless kept in check by judicious hunting, he might soon become a source of anxiety to the farmer. In view of this, the law provides that the lessee of field-shooting in Prussia shall drive-hunt the entire area of his lease not less than once in each year. Accordingly, the whole agricultural territory must be shot over by the *Treibjagd* process annually, and the operation is often repeated when the first hunt has left too large a surplus of hares for the next year's breeding. Drive-hunting for hares is not, perhaps, an exalted form of sport; but it is always sociable and jolly, and has the further advantage that it gets the hares.

For a well-organized hunt of this kind, from fifteen to thirty sportsmen are requisite, with twice as many men and boys from the neighboring villages, who are marshalled by the game-keeper to serve as beaters to drive the game. The fields or woods are then taken by sections as large as the line of hunters and drivers can surround, and, although with skilful shooting more or less game always gets through the line and escapes, the slaughter is often enormous. It is no uncommon occurrence for a party like this to kill in a

short winter day, upon 300 or 400 acres of wheat and beet fields within half an hour's drive of Frankfort, from 400 to 500 hares. As they average in winter about eight pounds in weight, the result of such a day's shooting would be nearly or quite two tons of game, — a quantity which it would be, of course, impossible to dispose of otherwise than by sale. Game killed in such quantities must either be sold or wasted; and in this country, where waste is considered sinful. the hares or deer or partridges, as the case may be, are turned over to the game-dealer, who during the season loads daily a special car for the Paris market. The game-dealer pays from fifty to seventy-five cents each for hares in Germany: they retail for from five to seven francs in Paris The French capital pays yearly millions of francs for game brought from beyond the Rhine. By the sale of his game, the lessee of shooting-grounds recoups, more or less fully, his expenditures for rent and keepers, and the money goes finally to the peasant or landed proprietor upon whose premises it was grown. From the beginning of the hunting season until the end of December, 1890, there have been killed in Prussia alone, according to official statistics, 2,500,000 hares, which, at 2.50 marks each, the usual wholesale price, represent an income of 6,250,000 marks, or nearly $1,500,000.

The invitations which are exchanged between sportsmen to make up the number of guns requisite for a drive-hunt constitute an important form of social courtesy in Germany. The entertainment always includes a mid-day breakfast, more or less luxuriantly served at the tavern in the nearest village or upon tables spread in the woods by servants, who bring warm dishes, wines, etc., from the home of the host in the city.

Such, in substance, is the German system. Could it be introduced successfully and profitably in the United States, and, if so, would such introduction prove desirable? Competent judges who have given the subject careful thought answer both these questions in the affirmative, and say that the game-laws of several Northern and Eastern States are already adequate to render the raising of game in the woods and fields of ordinary farms sufficiently secure to insure a successful result. A system which would add an additional crop to the farmer's fields and forests, and thereby increase substantially his cash income from his land, would certainly not lack support from the agricultural majority which controls most State legislatures.

There are, of course, many questions of detail which such an experiment would involve, and into which it is impossible at present to enter; but, after all that has been so successfully done in our country to restock the inland lakes and streams with fish, there ought to be some way of restoring in a measure the game birds and animals which were formerly so abundant, and which have become, through indiscriminate shooting, so rare to the sportsmen, so costly in our markets. This can only be done by making game-preservation easy, inexpensive, and withal profitable to owners of the land. The German system has made game abundant throughout the empire, and yields an important income to the class which is in most need of it.

The experiment in America would need to be systematic, but not necessarily expensive. A dozen pairs of partridges, pheasants, and hares, imported from Germany or Austria, turned loose on almost any American farm, and protected from molestation three or four years, would multiply so that they would thereafter hold their own against any reasonable and sportsman-like pursuit. The larger the territory included in such experiment, the more certain would be its success. There is the disastrous experience of Australia with the English rabbit, which might make some American farmers timid about introducing the hare; but it must be remembered that the European hare is a very different animal from the rabbit of either Australia or America. Besides being far less destructive and prolific than the rabbit, the hare does not burrow, and being, therefore, always above ground and accessible, its numbers can be easily kept within safe and reasonable limits.

NOTES AND NEWS.

ON Thursday, May 21, the second annual banquet is to be given at the Mercantile Club, St. Louis, in honor of Henry Shaw, the founder of the Missouri Botanical Garden and the Shaw School of Botany.

— Dr G. Baur will leave, May 1, for the Galapagos Islands, to be absent for six months. He intends to make the most careful examination of the fauna and flora of every island.

— At the annual commencement of the Jefferson Medical College, Philadelphia, on April 15, the honorary degree of doctor of laws was conferred on Dr. Daniel G. Brinton, in recognition of the merit of his researches in anthropology and ethnology.

— An international agricultural congress, says *Nature*, will be held at the Hague in September next, from the 7th to the 12th. A commission will be appointed at the Hague to arrange for the reception of the members.

— Dr. E D. Warfield, at present the president of Miami University, has accepted the position of president of Lafayette College at Easton, Penn. Dr. Warfield, who is but thirty-two years old, graduated with high honors from Princeton in 1882, and afterward from Oxford University, England.

— A meeting of the New York members of the American branch of the English Society for Psychical Research will be held, April 24. at 8 P.M., in Room 15, Hamilton Hall, Columbia College. Dr. Richard Hodgson, secretary of the American branch, will read "Narratives received by the Secretary." All persons interested are invited to attend.

— Bulletin No. 9 of the Agricultural Experiment Station of the Rhode Island State Agricultural School, Kingston, Washington County, R.I., is devoted to a record of experiments in apiculture, including the following subjects: "Artificial Heat for promoting Brood-Rearing;" "Hive on Scales, and Sources of Honey;" "Carniolan Bees;" "Foul Brood, its Cause, Prevention, and Cure." Samuel Cushman is the apiarist of the station.

— According to a telegram sent through Dalziel's Agency, a magnificent grotto has been discovered near Ajaccio. As described in *Nature*, it is entered with difficulty, owing to the smallness of the aperture; but upon his entrance, the explorer finds himself in a vast and lofty hall, the sides of which are some twenty-five yards in height. From this there are several passages leading to an indefinite number of other chambers. A thorough investigation of the grotto has not yet been made.

— Dr. Jordan, president of Stanford University, at Palo Alto, Cal., has completed arrangements for the appointments to the faculty of the university, and has made the following selections public: Dr. Andrew D. White, ex president of Cornell University, to be the non-resident professor of history; E. Stanford of Lake Forest University, to be the associate professor in physics; Horace B. Gale of Washington University, St. Louis to be professor of mechanical engineering; Professor Joseph Swain of Indiana University, to be the associate professor of mathematics; Douglass H. Campbell of Indiana University, to be the associate professor in botany.

— The following are some results of a study of 197 thunderstorms in Russia in 1888, with reference to their speed of travel, as given in *Nature* of April 2. The author (Herr Schönrock) obtained as mean velocity about 28.5 miles an hour, with variation

from 18 to 50 miles. In the hot season the velocity was less than in the cold (28 miles against 82 miles). It was least in the early morning, then increased, at first slowly, then faster, reaching a maximum between 9 and 10 P.M. Thunder-storms travel most quickly from south-west, west, and north-west. An interesting geographical difference was observed. From west to east the velocity increased at first; but about 30° to 35° east longitude a maximum was reached, and farther east the speed declined; the decline showing, however, a secondary maximum between 45° and 50°.

— With reference to observed changes in the earth's axis of rotation, says *Nature*, it has been pointed out that through changes in distribution of air-pressure and movement of water-masses, considerably differences of level in the ocean may be produced. Herr Lamp notes the displacement northwards of the maxima of air-pressure in the trade-wind region, and of ocean-currents, as the sun rises in summer. Thus a certain quantity of water passes over in summer from the southern to the northern hemisphere; and it is improbable that compensation takes place by means of undercurrents. As the year advances, water passes back to the southern hemisphere, reaching there a maximum in our winter. This periodical transferrence of mass is supposed to cause periodical variation in the earth's axis. Herr Lamp calculates that to cause a change of latitude of 0.5", it would be sufficient, that, at 180° longitude from Berlin, a water-mass of 2,500 cubic metres should move in a meridional direction from 30° south latitude to 35° north latitude; and that, with reference to the oceanic area concerned, we need only suppose a mean elevation of 10 centimetres (or 4 inches) in the sea level.

— The annual report of the Berlin branch of the German Meteorological Society contains the results of rainfall observations at a number of stations in and near Berlin for the year 1890. This year is among the dryest experienced since 1848, when regular observations were begun. The months of February and September, especially, are the dryest on record. Dr. Hellmann, the secretary, has carried on some useful experiments to determine the influence of the height of rain-gauges upon the records of rainfall, — a matter of considerable importance in towns, owing to the difficulty of obtaining a good exposure at a low level. He finds, according to *Nature* of April 2, that about a quarter of the rainfall is lost in an elevated exposure, such as on the roof of a house, during strong winds; but he arrives at the important conclusion that an elevated exposure is permissible if the gauge can be protected from the disturbing influence of the wind. The report also contains a list of the severe winters since 1728. The coldest winter was 1788. On Dec. 28 a minimum of —21.6° was recorded.

— A new method has been devised and patented in England for ascertaining the requisite time of exposure in photography. An instrument for measuring the relative intensity of the photographically active rays reflected from any landscape or other object by observing the time required for the light from a phosphorescent compound to fade from its maximum intensity to the intensity of the light reflected from the object, is employed. It consists, according to *The Engineering and Mining Journal*, of an opaque tube with an eye-piece at one end; while at the other is a plate of glass, part of which is coated with Balmain's paint, or some similar phosphorescent substance emitting only rays which act upon an ordinary photographic plate. The paint must either be opaque, or must be made opaque by means of a backing. Behind this glass is a piece of ground-glass, and there may also be a piece of blue glass cutting off from the light reflected from the object all rays except those which act on a photographic plate. The frame carrying these glasses is hinged, so that it can be turned back in order to expose the phosphorescent substance to light. When a measurement is to be made, the frame is turned back and the phosphorescent surface is exposed to daylight, or to the light from burning magnesium, for a time sufficient to excite the maximum luminosity. It is then put back in position, and the apparatus is at once directed toward the object to be photographed. The light reflected from this object passes through the unobstructed portion of the ground-glass and blue glass, and at first appears dark as compared with the light from the phosphorescent surface. The brightness of the latter, however, gradually fades, until the two lights are equal in intensity. The time required for this to take place is observed, and, with this datum and a series of tables supplied with the instrument, the exposure necessary to obtain a good photograph of the object in question is ascertained.

— Steps are being taken in Paris to prepare the way for the holding of an international colonial exhibition next year on the Champ de Mars. According to the Paris correspondent of the London Times, the sections would be geographical, not political; all the West Indies, for instance, forming one section, all India another, and so on. Specimens of all the native populations would be brought over and housed as at their homes, and two congresses — a colonial and an ethnographical — would be held.

— The mineral hornblende has been artificially reproduced in well-formed crystals by M. Kroustchoff, and an account of his experiments is communicated to *Comptes Rendus*, an extract from which appeared in *Nature* of April 9. The last few years have been most fruitful in mineral syntheses; so much so, indeed, that there remain very few of the more commonly occurring rock-forming minerals which have not been artificially prepared in the laboratory. M. Kroustchoff, who not long ago described a mode of preparing most perfect crystals of quartz, has made many attempts to reproduce hornblende, and has at length succeeded by the adoption of the following somewhat remarkable process. This process essentially consists in digesting together for a long period of time, *in vacuo*, and at a high temperature, the various oxides contained in natural hornblendic amphiboles, in presence of water. Small flasks of green glass were employed, each of which was exhausted by means of a Sprengel pump after the introduction of the substances to be digested together. The ingredients digested consisted of (1) a dialyzed three-per-cent aqueous solution of silica; (2) an aqueous solution of alumina obtained by dissolving aluminum hydrate in an aqueous solution of aluminum chloride, and subjecting the solution to dialysis; (3) an aqueous solution of ferric oxide obtained by the addition of ammonium carbonate to ferric chloride in such quantity as to redissolve the precipitate first formed, and dialyzing the solution; (4) carefully prepared pure ferrous hydrate; (5) lime-water; (6) freshly precipitated hydrate of magnesia; and (7) a few drops of caustic soda and potash. The mixture presented the appearance of a gelatinous mud. The exhausted and sealed flasks were placed in a specially constructed iron many-chambered furnace, and heated for three months to a temperature of 550° C. At the expiration of this time the appearance of the contents had entirely changed, having become much darker in color; and distributed throughout were numerous brilliant little crystals, almost black in color, and reminding one forcibly of natural hornblende. On systematic examination, they were found to consist of flattened prisms identical in character with hornblende. Under the microscope they exhibited the hornblendic yellowish-green color and pleochroism. Their index of refraction was the same as that of natural hornblende, about 1.65. The angle between their optic axes was found to be 82°: that of natural crystals varies from 80° to 85°. Analyses gave the characteristic amphibolic percentages, that of SiO_2 being 42.3. In addition to these crystals of hornblende, it is interesting to note that pyroxenic crystals resembling those of the augite family were also found in the flasks, together with crystals of a zeolite and of a variety of orthoclase felspar; and, finally, some exquisite little quartz crystals were observed, showing cavities containing liquids and bubbles resembling those of natural rock crystals.

— Welch, Fracker Company, New York, have in preparation "Ohio in Art," by Francis C. Sessions, president of the Ohio Archæological and Historical Society, to be illustrated with etchings, photogravures, and many smaller cuts, reproduced from the most notable works of Ohio artists. Among these may be named Otto H. Bacher, James Beard, W. H. Beard, Robert Blum, Theo. E. Butler, Thomas Cole, Kenyon Cox, Charles C. Curran, John J. Enneking, C. H. Eaton, E. Peixotto, Hiram Powers, J. H. Twachtman, Edgar M. Ward, J. Quincy Ward; to be sold by subscription only.

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Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

THE DESTRUCTION OF THE WAVE THEORY.

AT brief intervals of time the scientific world is startled by the announcement that some one of its favorite and supposed permanent and well-established theories in science is annihilated by a new genius in the field of research. On investigation, however, it has thus far invariably proved that the supposed iconoclast is slightly in error; and the theory usually stands firmly until another bold martyr appears to shake but not to overthrow it. The last of these brave but unknown and unknowing martyrs to science, as we fear, may be found quixotically attacking the wave theory of sound in the columns of the *Monthly Journal of the British Society of Musicians*, in the issues of March and April.

Mr. George Audsley supports the "substantial" theory of sound with courage, if not with knowledge and discretion, and puts to flight such advocates of the old notion of vibration as Professor Tyndall in Britain and Professor Mayer in America; at least, those gentlemen seem not to have remained on the field of battle. Mr. Audsley points out the fact that the stridulations of the locust affect the air for miles around, remaining audible even when reduced four thousand millions of times, and takes this as ample and positive proof of the folly of the accepted theory, a *reductio ad absurdum*, in some sense, certainly, beyond the suspicion of a question. Unfortunately he has no exact measurements and no accounts to give us of experimental research to sustain his onslaught; but that fact seems to him unimportant.

Scientific authority in the United States comes to the support of Mr. Audsley also. "Professor" E. J. Drake, presumably an authority, and accomplished in experimental investigation, — although we lament that we must confess our ignorance on this subject, never having heard of these "authorities" at such meetings of the learned societies as we have had the good fortune to attend, — gives Mr. Audsley the benefit of his victory over Professor Tyndall, and the "startling" results of experiments at the Pennsylvania Military Academy by Capt. Carter as related to Professor Tyndall, without, unfortunately, convincing that hard-headed "scientist," who replies only thus: "You may go to rest with the assurance that the wave theory of sound is perfectly secure."

Mr. Sedley Taylor ventures to mildly uphold the endangered theory, however, and presents very admirably what little can be said in favor of the sound-wave; but both he and Tyndall, and presumably Mayer, are met by the somewhat intimidating accusation of "scientific cowardice," and, it is feared, may be driven from the field, leaving the sound-wave theory to stand as best it can.

Nevertheless, every one studying the physical sciences will be interested in learning who these bold soldiers of a forlorn hope be, and what is the experimental evidence on which they rely. Truth must in the end prevail; and it is only necessary to secure experimental evidence of the new ideas to insure their acceptance. Facts, not words, are needed. What man of science of known ability and experience in research will be the first to prove the material theory of energy-transmission through elastic substance? Messrs. Audsley and Drake are with him, and will bravely claim for him deserved honor.

If we may venture the suggestion, however, to such able and learned men as are engaged in this grand crusade, we would modestly intimate the possibility that the trouble is not so much with the wave or any other "theory" as with the facts; not that one or another explanation of the *modus operandi* is unsatisfactory, but that a minute insect can, by any natural process, shake such enormous masses. Is it not, after all, a miracle which our bold crusaders have discovered?

UNIVERSITY EXTENSION. — HISTORY OF THE PHILADELPHIA LOCAL MOVEMENT.[1]

THE success of the university extension movement in England has been closely watched by those interested in higher education in this country for a number of years; but, as the problems here presented were in many respects radically different, there has been a great feeling of hesitancy anent the initiation of the work in this country.

Before any general movement was attempted, it seemed advisable that an experiment should be made in some one place, and a thorough test had. To secure this end, an informal meeting was held in Philadelphia early in the spring of 1890, at the request of the provost of the University of Pennsylvania, to discuss the feasibility of transplanting the English system. It was seen at once that Philadelphia and its immediate vicinity offered, as a place in which to try the experiment, advantages possessed by no other. Here was a compact city made up of parts originally independent; here were in close proximity not only flourishing suburbs, but a large number of towns and villages; and last, but not by any means the least important, in this field, there were found more institutions for higher education with which it would be possible to co-operate than in any other section of the country.

Immediately it was resolved to make the experiment, and the first step was the organization of the society. The co-operation of the teaching bodies in and adjacent to the field was asked, and it became evident from the hearty responses received on all hands that there would be sufficient teaching force available for the work. The next step was to invite the co-operation of existing bodies interested in liberal culture. Again the hearty responses received, in a measure foreshadowed the successful inauguration of the work.

It was then resolved to send the secretary abroad to make a study of the movement at its fountain-head. During his sojourn in England, he made a careful examination into the plans of organization and method of work of the Cambridge Syndicate, the Oxford Delegacy, the Victoria University, and The London Society for the Extension of University Teaching. Upon his return

[1] From Bulletin No. 1 of the American Society for the Extension of University Teaching.

in the fall, he drew up a careful report, which was printed, and may be had on application. The organization of the "local centres," as they are called, was at once actively entered upon.

In organizing these local centres, the society endeavors to coöperate with, and as far as possible work through, existing institutions. In almost every case we have found some organization which possessed a hall, and was willing to take up the work, and to grant the use of the hall rent-free. The first centre established was that at Roxborough, in connection with the St. Timothy's Workingmen's Club and Institute. They opened their first course on chemistry on the 3d of November, 1890.

The following is a list of the centres that have been established, and the courses in progress at the same: Wagner Institute, zoölogy, chemistry, geology, psychology, and two courses in English literature; Association Local Centre, in connection with the main branch of the Young Men's Christian Association, astronomy, biology, higher mathematics, and two courses in English literature; West Philadelphia, American history and English literature; Frankford, American history and English literature; Holmesburg, American history and English literature; Germantown, English literature and electricity; Spring Garden, mathematics and two courses in English literature; Wissahickon Heights, English literature and European history; South Broad Street, American history and electricity; Women's Christian Association, biology; United Club and Institute, English literature; Norristown, two courses in English literature; Camden, N.J., English literature; Lansdowne, electricity; Media, English literature; Haddonfield, N.J., European history; Newark, Del., English literature; Mount Holly, N.J., American history; Downingtown, Penn., English literature; Trenton, N.J., English literature; Wilmington, Del., English literature.

To summarize what has been done thus far, there have been forty courses, with an average attendance of 9,250 (estimated), and two hundred and fifty lectures, with a total attendance of 55,500 (estimated).

Applications for the formation of local centres have also been received from Salem, N.J.; Bryn Mawr, Penn.; Reading, Penn.; Bristol, Penn.; Gloucester, N.J.; Woodbury, N.J.; Woodbourne, Penn.; Williamsport, Penn.; Wilkesbarre, Penn.; West Chester, Penn.; Lebanon, Penn.; Towanda, Penn.; Collegeville, Penn.; Rahway, N.J.; Doylestown, Penn.; Hazleton, Penn.; Lancaster, Penn.; Bridgeton, N.J.; Pottstown, Penn; North Wales, Penn.; and Staten Island, N.Y.

The courses vary in length from six to twelve lectures. The method adopted is, first, to have the lectures last about an hour, after which the students form themselves into a class to pursue the subject further. In connection with each course there is issued a syllabus, giving a full outline of the lectures, together with suggested lines for collateral reading. In addition to this, it also contains at the end of each lecture a series of exercises, which the student prepares at home and mails to the lecturer, who returns them at the following class with his comments noted on the margin. At the end of each course an examination is held, upon the basis of which, together with the weekly paper work, certificates are awarded.

This short statement gives the public a fair idea of our general work as we have entered upon it and carried it out. It is hoped that general interest will be felt in this plain statement of facts regarding a novel attempt at higher education with its surprisingly successful results. We desire also to state what is our main aim in this university extension work. It has been too long the system to keep university forces, teaching, and methods shut up entirely within classrooms, and to leave the great mass of people without the opportunities of having their minds fertilized with great thoughts, their studies carefully guided, and their knowledge lifted from a lower to a higher plane by this systematic university teaching; for it must be noted especially that the teaching contemplated in this movement is of real university grade, conducted by teachers of the first rank, and by methods which have proved themselves capable of giving results fairly comparable with those obtained within academic halls.

We propose, then, to carry this university work out into the general community as far as practicable. It will afford to all, however pressed with practical duties, or hindered by lack of funds, the opportunity of acquiring recent and exact knowledge, and of sharing in the stimulating discipline of genuine educational methods. These methods adopted by the society are flexible, and well adapted to the objects in view.

The society aims to make its local centres self-supporting. With proper efforts at each centre, this can usually be accomplished; but it is evident, that despite this, and despite the generous coöperation of many eminent teachers, large expenditures of money will be required.

We are happy to announce that the continuance of the work is secured by a liberal guaranty fund for five years. It is, however, believed that all will recognize this new national educational movement as judicious as well as generous, and that its claims will appeal forcibly to very many minds. It is earnestly hoped that all who realize its importance will become members of the society, and assist in the development of the work.

MICHIGAN STATE SANITATION.

THE annual meeting of the Michigan State Board of Health was held April 14 1891. Professor Fall, Drs. Avery, Hazlewood, Vaughan, and Baker, were present. Dr. Avery was re-elected president. Dr. Vaughan reported that at the State Laboratory of Hygiene he has made analyses of all the different kinds of baking-powder found in the market, also of one hundred and twelve samples of water from different parts of the State, and that he was ready to report the results, also of his researches on typhoid-fever. Dr. Baker reported that he had worked out the cause of influenza. He said its greatly increased prevalence during the last three months is alarming, because so many other diseases follow that disease, and increase after it increases; the diseases which so increase being consumption, pneumonia, cerebro-spinal meningitis, rheumatism, osteo-myelitis, etc., influenza seeming to bring in its train all of these most important diseases. Dr Baker explained the causation of influenza. He stated that the germs of influenza are generally at all times present, and the germs of pneumonia, tuberculosis, and of the other specific diseases are somewhat widely disseminated, but that there must be certain coincident meteorological conditions to irritate the throat and air-passages sufficiently to let the germs gain an entrance to the body. These meteorological conditions, in this instance, were the excessive prevalence of north and north-east winds, and the excessive amount of ozone during the past three months. The prevention of influenza, and of the coincident rise in the other more dangerous diseases, has not been possible, because of ignorance of the causes. Now the causes are known, and the study of the measures for the prevention can begin. How to get more thorough disinfection after contagious diseases, was brought up by Dr. Hazlewood, also by letter from Dr. Nicholson of the Upper Peninsula, and also by other correspondence of the office of the board It seems to be made plain, that, if the bill now before the Legislature (Senate Bill 257, House Bill 640) shall become a law, making a small appropriation to enable the State Board of Health to send an inspector to the localities where most needed, to aid in the final disinfection after cases of dangerous diseases, the spread of those diseases can be very greatly lessened, and hundreds, and possibly thousands, of lives can be saved in Michigan in every year.

PORCELAIN INDUSTRY IN FRANCE.

THE United States consul at Limoges says, in his last report to the United States Government, that the proprietors of the large porcelain-factories there have been for a long time studying the question of reducing the price of fuel. At a recent congress of the manufacturers, it was said that some new and cheap way of manufacturing porcelain must be found for France, or the industry which has become so famous, and which employs so many of the inhabitants, would be driven from French soil on account of the cost of firing. It was there ascertained that the cost of firing china in Bohemia was not more than 10 francs a ton; in England it was only 13 francs; while, for the same thing in France, at Limoges, the cost was between 34 and 35 francs. This difference

being so great, and making it impossible for the French manufacturers to make their china as cheaply as their foreign neighbors, various devices have been tried, but with little success. In order to compete, wages have been reduced to the lowest point, and still the manufacturers are said to have lost money. The coal that is employed is necessarily costly, as a smokeless, long-flame variety is required. Many of the factories burn wood only, as that produces a purer white than the very best kinds of coal; but wood is dearer than coal. It is consequently only used in firing the muffles, and in the finest grades of porcelain. A few years ago a new process was tried, that baked the porcelain in a short time; but the cost made the process impracticable. It was under such circumstances as these that one of the most progressive houses in Limoges was induced to employ petroleum or residuum oils as a fuel, to accomplish which, an American firm using the Wright burner was requested to make a trial with the fuel. There was very much doubt and fear connected with the experiment; but after a time it was attempted, and the results were far better than anticipated. The heat was shown to be absolutely pure. No gases or smoke in any way discolored the china, which came from the kiln much whiter, and in better condition, than when it is fired with the best of wood. In the muffles there was a decided advantage. The delicate colors, which show at once the presence of the slightest quantity of gas, were perfect. "This new discovery," says Consul Griffin, "promises to revolutionize the whole porcelain industry." It is estimated, that, by employing these oils, there will be a reduction of about 15 or 20 per cent in the making of china. The only question now is the present classification of residuum oils in the customs tariff, as the present duty on petroleum — 120 francs per ton — is prohibitive; but strong pressure is being brought to bear on the French Government to have fuel oils classified as fuel, which pays only 1 franc 30 centimes a ton. New life is given to an industry that was seriously threatened; and it is hoped that the French porcelain will be brought to a greater state of perfection by this new American invention.

MEXICAN ARCHÆOLOGY.

Mr. Carl Lumholtz writes, "Since I wrote last, I have had an interesting though sometimes rather rough time of it, crossing Sierra Madre in December and January. We had snow several times, and the grass is of poor quality, so I lost altogether thirteen of my animals. There are three Sierras to cross at an elevation of about nine thousand feet: you may therefore easily imagine what a rough country it is to traverse in the winter-time, making our own trails. I had thirty men and about a hundred animals, and I pulled through all right. My camp is now near Casas Grandes in Chihuahua, where my animals are resting The scientific result is very satisfactory so far. The most interesting things I came across were some wonderfully well-preserved skeletons in a series of caves. In some of the caves were small villages; others were reserved as burial-places, and here I dug out several of the above-mentioned skeletons, the porphyry pulp having preserved for centuries the corpses so well as to be made into some kind of mummies. The features on some are complete, even hair and eyebrows still there. These people were of small stature, and bear a striking resemblance to the Moqui Indians of the present day. In the eastern slopes of Sierra Madre I also dug out many mounds, and every day brought to light fine stone implements and beautiful pottery. I might profitably spend two years in excavating mounds only; but I am going on with this kind of work only till the end of April, when I start out again in the mountains. Among the fossils found on the western slopes of Sierra Madre, near Nacory, is a huge horn six feet eight inches long and twenty-six inches at the largest circumference, probably belonging to some extinct bison. Many birds and plants (about two thousand) were found. I am entirely confident of the success of the expedition. Next time you will hear that I have found people alive in the caves. There is a wonderfully rich field before me, and I know that my expedition will bring greater results than anybody at present anticipates. But the expenses are far greater than I expected. My animals only cost three thousand dollars. In December and January I paid wages each month, respectively, $1,000 and $1,025. I mean to reduce my force; but a small party cannot well travel here, as there are plenty of Apaches, and farther south any amount of bandits that are equally bad. I now have a fine gang of men and every thing in regard to outfit complete, speak Spanish fairly well, am on excellent terms with the Mexican Government (they imprisoned lately for three years an inspector who stopped my provisions last fall), and the field before me is of exciting interest. But more material support will be needed, if I shall not have to go just with two or three men. Still, I am determined to do even that, because I must accomplish my aim. I am now on a fortnight's trip to the United States to see some friends that I think may give me further support, and on the 26th or 28th of April I expect to be on the march again."

HEALTH MATTERS.

Influence of Exercise on Digestion.

Dr. Streng, in a lecture before the Medical Society of Giessen, on "The Influence of Exercise on Digestion," an abstract of which appeared in the *Lancet* for March 7, states that he concludes from his own experiments that this influence is of a retarding nature. His experiments, however, suffer from the fact that he always injected 300 cubic centimetres of water before obtaining the contents of the stomach, so that the proportion between gastric juice and water continually varied. The first experiments in the clinic at Giessen were made on two dogs. Twenty-five grams of meat suspended in 300 cubic centimetres of warm water were twice injected into the fasting stomach; and after one feeding, the dogs were compelled to remain for three hours in absolute bodily rest, while after the other feeding they were made to take active exercise. After the three hours, the contents of the stomach were obtained and analyzed. The quantity did not essentially differ in the two cases: the experiments consequently tended to prove that exercise does not influence the time required for digestion. The chemical analysis also detected no difference. The same results were obtained by substituting the white of an egg for the meat. The experiments were then repeated twenty-five times on three men with healthy stomachs. Two of these suffered from sycosis, and the third from insipient muscular atrophy. They were fed each time with 200 grams of minced meat, a bun, a plate of bouillon, and three spoonfuls of mashed potatoes, and the contents of their stomachs were obtained four hours and a half afterwards. The exercise after meals consisted partly in gymnastics, partly in walking. Absolute rest was obtained in bed. These experiments gave the same results as those on the dogs, the difference resulting from the chemical analysis being especially imperceptible. The author therefore concludes that the gastric function is in no way influenced either by muscular action or by absolute rest.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

The Pollination of Zea Mays.

The brief report, in *Science* of March 27, of the interesting experiments with American corn at Cornell University does not give the results of the control tests, and thus fails to prove that removing a number of the tassels from a corn-field increases the yield of the emasculated stalks. The standard given for comparison is the yield of certain stalks under abnormal conditions.

The experiments of Darwin, Gaertner, and others, make it probable that the fertilization of a monœcious organism with the male element of another individual of the same species increases the vigor of the progeny, and, conversely, that self-fertilization either results in sterility or a weakened progeny.

Applying this biological law to the corn-field in question, it might be claimed that the stalks which were allowed to tassel were self-fertilized to an abnormal degree, and thus were weak-

ened, reducing their yield below the normal. It might be claimed also that from the reduced amount of pollen, and the shock of the injury, the yield of the emasculated stalks was also reduced below the normal, and thus that removing the tassels really reduced the yield.

All claims of decrease or increase rest on mere probabilities, unless the control experiments are known. The produce of a like number of rows in the corresponding situations on the other side of the corn-field would give the normal yield. Simpler, though less accurate, the average yield of the untreated portion of the general field would suffice for a standard.

The great number of undeveloped grains on the ears of isolated corn-stalks and on the borders of fields may be due to self-fertilization; but, as a like frequency of undeveloped grains occurs on the cobs of corn whose tassels have been blasted by the western hot winds, the non-development may be due to lack of pollen.

As it does not seem reasonable that there was any lack of pollination in the Cornell University corn-field, the results of the control experiments may prove the claimed increased yield, and may also be another proof of the injury of self-fertilization. But these results may show that the decreased yield of the abnormally self-fertilized stalks more than counterbalances the increased product of the maimed stalks. DICE MCLAREN.

Baltimore, March 31.

Homœopathy in Relation to the Koch Controversy.[1]

EVEN the authority of Dr. Koch's eminent services has been unable to uphold parataloid in the terrible search-light of the Virchow and Chiari necropsies; and it is questioned whether the reported improvement of Kaposi's cases of lupus promises permanent cure in that form of tuberculous disease. Experience with Koch's fluid in this country has afforded results no more favorable. Koch, nevertheless, hopes "to extract from the tubercle bacillus its curative substance alone," and there remains on all sides enduring hope that true curative power can be liberated from the parataloid.[2]

Is it generally known that the homœopathic school has for many years made use serviceably, not poisonously, of Koch's material in the treatment of consumption and other tuberculous disease? For twenty years this most misunderstood and maligned body of observers has recognized the indispensable curative service of the products of disease, and, in addition, the necessity[3] for their extreme attenuation, before they might be safely administered in sickness. "Tuberculinum," "anthracin," and "sycotin" belong with such drugs as arsenic, which develops dangerous lesions if given to persons in health, but is curative in certain disturbed conditions. The testimony given by these physicians appears singularly fitting, and their experience would be of vital importance at this time of wholesale experiment threatened by the followers of Koch. I will now attempt to describe the cultus and professional training of these men who are accused by the dominant school of failure to accomplish any thing for medical science, of bigotry, of narrowness, and of "having a fixed belief."[4]

The college requirements for students of homœopathy do not differ materially from those of the older school. Many of these students are already graduates of Harvard or of foreign medical schools, who afterward finish their studies at a homœopathic college.

"By their fruits ye shall know them." Among the noteworthy results of a professional education in the methods of this school has been the discovery of unexpected remedial agents far in advance of other medical investigators. The homœopaths have long recognized the life resulting from death in natural growths, and have not hesitated to explore filth, decay, and disease for morbific products or nosodes. Diseased material from animals and plants, and the poisonous secretions of reptiles, fishes, and insects, are found to be indispensably curative in desperate or obscure diseases, but are only thus helpful when the powers of each have been clearly differentiated by a thorough proving. Is it generally known what is meant by a proving or study of a remedial agent? Let me, then, briefly show you the labor, the research, and the professional skill required to make a proving.

A proving is made by administering to several healthy persons a substance or extract, and recording its effects, with the ultimate object of using the proven material in disease. Each agent must be studied[1] with regard to its chemical, functional, and the whole pathological effects in the body. Study the pulse, actions of the heart, lungs, brain, kidneys, liver, systems of nerves, blood-vessels, lymphatics, glands, digestive organs, machinery of the senses, each anatomical part and tissue. Study the connection of the proven material with eruptions, parasites, contagions, climates, influences inherited or acquired. Note the resemblance of this to other drugs and its antidotes. Above all, there must be perceptions of mental states, tact to avoid deceit, artistic insight, and quick sight; for all these matters, sought out by stethoscope, ophthalmoscope, sphygmograph, microscope, analyses of the urine, blood, etc., and the whole armentarium of a modern physician, enter into the preparation of a proving, and must be brought together with laborious, painstaking care before the proving is offered.

Professor Constantine Hering prepared in the year 1850, for his colleagues of the medical college at Allentown, Penn., a scheme of twenty closely written pages, — simply directions for epitomizing and recording their provings. The systematic habit of German university training which has given their prestige to German scientists was thus early brought to bear upon students in this matter.

A proving is accepted, and enters materia medica and text-book, only after its characteristics have been confirmed by scores, often by hundreds, of independent observers.

At last the proving stands, full of interest, a new discovery, an elaborate, sometimes a learned analysis, entirely unknown to old-school methods, and one more weapon is ready for use.

The authorized works of homœopathic materia medica are very numerous: fully eleven hundred remedies are available.[2] Many practising physicians carry in memory the chief characteristics of the greater proportion of these.

Provings, and the repertories founded upon them, naturally differ in value; yet a curious observer must, I think, find in the general result the evidence of such persistent industry and scientific research, that all statements which assume a lack in either respect obviously proceed from uninformed persons.

Regarding attainments in literature and the liberal sciences *per se*, — a welcome addition, no doubt, to the real service of medical men, and the supposed lack of which on the part of these practitioners has been made the subject of grave comment,[3] — to four bright spirits only, in all these two thousand years of physicians, have seats been assigned among the immortals. Hippocrates, Galen, Sir Thomas Browne, finally Dr. Holmes, have severally gained a place in letters. Each of these is a rebel and an innovator, for without rebellion and innovation was never yet wrought any good thing. But fifty years have passed since the death of Hahnemann, himself a man whose vast learning was fully recognized in his time.[4] Meanwhile neither poet nor sage has yet chanced to be "an ornament to his profession." The fact is, its founders have been at work so hard that they have had no time to hold up their heads to sing.

[1] Abstract of a paper by C. F. Nichols, M.D., in Popular Science News, April.

[2] See Report of the Imperial and Royal Society, Vienna; Medical News, Jan. 17; Boston Medical and Surgical Journal, March 5; Medical Record, March 7, 14, 28; Lancet, March 28.

[3] "Koch usually injects only one-millionth of a gram of the active principle. From the effects of this inconceivably minute quantity some idea may be formed of the almost uncanny energy which the substance would display if let loose, so to speak, in the fulness of its untamed strength" (Sir Morell Mackenzie, in the Contemporary Review). "One part to a ninety-eight billionth of the bulk of the whole body in a man weighing fifteen stone," is Dr. Hine's estimate (London Lancet, Feb. 14, p. 357).

[4] See Professor H. C. Wood's Yale address, also addresses published in Medical and Surgical Reporter, all previous to November, 1889.

[1] Usually in a so-called college of provers.

[2] Boenninghausen's Repertory, an early publication, might fairly be compared with Roget's Thesaurus or a modern lexicon. The recent compendiums (of which three are available) aggregate many hundred pages of closely printed text.

[3] See letter in the London Times, Jan. 8, 1889; also Dr. D. K. Newell's annual address before the Massachusetts Medical Society, 1890.

[4] See the writings of Jean Paul Richter and Broussais.

Let us now inquire what has been accomplished for medical science by the elaborate provings of the homœopaths; for the *raison d' être* of a proving has not been explicitly given in the preceding pages. Hippocrates, Hahnemann, and Sydenham hypothecated, and finally taught, that the proving or testing of medicines upon the healthy would show the exact curative power of each remedy in disease. This doctrine was formulated by Hippocrates in the aphorism or axiom *similia similibus curentur* ("cure by similars"). Jenner by vaccination, and Pasteur and Koch by their inoculations, have more recently illustrated the effects, under this hypothesis, of a limited class of remedies; but to Hahnemann and his successors alone, with their elaborate system of full descriptive provings of nearly every known medicinal agent, is due the gradual establishment of a law educed from the original working hypothesis of Hippocrates.

That the law of similars cannot be explained *a priori* (i.e., upon any material or mechanical grounds) is, to my mind, at once to be admitted before we can accept it as a fundamental principle or starting-point, exactly like that of electricity or chemical force. The law is, that disease is cured by an influence similar to that which produces it. However daring the first assumption of this law of similars, it has now passed through the stages recorded in the history of every established science; i.e., it has been submitted to induction, deduction, and verification.

Mere observation of instances is not inductive, and does not lead to science until, through the study of instances, we rise to fixed law. With such a law, prophecy or deduction must be possible; and the accuracy of this prophecy or verification will be a fresh test of the original law. The homœopathic law, being tested in reference both to normal and the diseased conditions of the human body, has the logical advantage of a double verification, and may thus be said to be rediscovered every day in the practice and provings of each homœopathic physician.[1]

It is, then, law, not luck, which has enabled the homœopaths to reach their very consistent results. Their remedies in common use are an emphatic demonstration of the practical value of the law of similars: such as mercurius, which causes eruptions, salivation, and diarrhœa, and is undeniably curative in these forms of disease; quinine, which, causing ague symptoms, relieves them; nitroglycerine, which removes the form of congestive headache inevitably produced by it in a healthy person. And if the imperfected discovery of Koch be, indeed, a conspicuous and brilliant blossom of medical science, it is the startling fact that this law of similars plucked the flower long ago, and, aided by its accessory of safe dilution or attenuation, has made intelligent use of its discovery.

To confine our attention to testimony bearing directly on the treatment of tuberculous disease. The proving of tuberculinum shows, as its primary effect, evidence of a deposit of tubercle at the base of the brain. Severe and unbearable headaches are a prominent symptom, with local congestion, delirium, and insanity; more remotely and as later manifestations, cough, purulent sputa, and diarrhœa. The remedy tuberculinum has been for years helpfully given in meningitis, hereditary and inveterate headaches, hectic fever, night sweats, cough with tuberculous expectoration, and all early stages of phthisical disease.

It would thus appear, that, in those first stages of consumption which alone are claimed to be curable by the injection of Koch's fluid, the homœopaths have made safe yet effective use of the same materia morbi as Koch's.[2] Instead of protection by boiling, cultivation, etc., a high attenuation has been efficient.[3] This attenuation, made chiefly by means of dilute alcohol, is claimed to accomplish something beyond the mere subdivision of material. The irritant particles are mechanically detached, while the curative principle is separated and developed. The degree of attenuation used always ranged as high as a so-called thirtieth potency. After Darwin's statement of the minuteness of the spores of drosera capable of producing their characteristic action, the efficiency of a potency or attenuation does not to many persons seem improbable; and we will leave, for the present, the mathematics so frequently discussed.

[1] "Science presents itself as exact and verified knowledge; . . . if observation and verification cannot demonstrate the real existence of the genus, philosophy itself, in any sane sense of the word, is annihilated" (Dr. F. E. Abbot, The New Ideal, May, 1889).

[2] See New Organon, July, 1879, pp. 342, 489, 449; Dr. Swan's Morbific Products, 1886; Burnett's New Cures, 1885 to 1890: J. A. Biegler's Report; C. Hering's Guiding Symptoms, vol. x. (now in press).

[3] Attenuations thus far made by the French experimenters have been unsatisfactory, both on account of the uncertain strength of the dilutions, and also by reason of changes of quality wrought by cultivation of the original material. The writer is aware of Koch's statement that the albuminoid principle of parataloid is insoluble in alcohol. The simple dilution of the latter avoids this difficulty, chiefly by checking its coagulative effect.

It will readily be seen, however, that treatment by nosodes might soon degenerate into an enthusiastic, thoughtless, and empirical use of these remedies, to the exclusion of others, if the inference were drawn that each microbic disease could be annihilated by its own potentized product; and it has naturally been found impossible to remove, by the administration of its nosode alone, the whole ultimate disturbance, in the form of secondary symptoms, sequences, and diseases of distant parts of the body. Indeed, other remedies might, even from the beginning of treatment, be more serviceable than these. Thus, in faithful treatment, it is sought to accomplish an end far more subtle than the mechanical removal of bacilli. Holding them to be merely parasites, among which may exist many forms not inimical to health, but even fulfilling protective service in the body, the homœopath does not consider it essential that its bacillus be seen in the atom of diseased material which he prepares for medicinal use (the bacillus would almost necessarily be there, for each characteristic parasite is the carrier of the disease in which it dwells); but it is the deadly material[1] in which the microbe-parasite feeds which alone is desired for proving, finally for prophylaxis and therapeutic use.[2]

The ancient school attacks the new, having known but little of its large work; but the time has gone by for dismissing without a hearing such claims as led Wilson, the anatomist, to employ homœopathy for himself, and Sir Sidney Ringer to incorporate, *verbatim*, large sections of its materia medica in his authoritative work.

These are the stars in the firmament of homœopathy, — men of affairs, men of business, scholars, warriors, poets, statesmen, whose practical wisdom has moulded the destinies of the world,— Sir William Hamilton, Archbishop Whateley, Carl Wilhelm Siemans, Lord Lyndhurst, Augustus de Morgan, Secretary Seward, Lord Lytton, Charles Reade, Wendell Phillips, Theodore Parker, Helen Jackson, Miss Phelps, Balzac, Gambetta, D'Israeli, Bismarck.

Instead of such awkward use of its weapons that the force powerful enough to combat the disease must destroy also the invalid, homœopathy, *die milde macht*, has quietly employed its methods, "strong enough," as Wendell Phillips once remarked to the writer, "to wait until its accumulating facts would speak for themselves." C. F. NICHOLS.

Boston, April 15.

Iroquoian Etymologies.

I WISH to make a correction. In my article (*Science*, April 17, 1891), instead of the word rati*kowaněñ*, on p. 219, second column, at the end of the first paragraph, read rati*kowaněñ's*. This error was perhaps due to an oversight of the copyist in transcribing with a typewriter from my script notes, and overlooked in revision. J. N. B. HEWITT.

Washington, D.C., April 19.

BOOK-REVIEWS.

Power through Repose. By ANNIE PAYSON CALL. Boston, Roberts. 16°. $1.

THE tone and object of this book are thoroughly good. The warning that it sounds is similar to that which Dr. Weir Mitchell so earnestly voiced in his "Wear and Tear." We are wearing and tearing too much and too fast. We are losing the faculty of

[1] The bacillus not only maintains its own parasitic life in the body, but appears itself to manufacture, or subverts the nutrient function to produce various toxic substances which are poisonous, though separated from the bacillus (see Popular Science News, March, 1891, p. 43, quoted from Edinburgh Medical Journal).

[2] See Swan's Nosodes; Burnett's New Cures.

resting, the power of repose. The prevailing disease of our modern steam civilization, so accentuated in our country as to receive the name of "Americanitis," is the result of this constant nervous tension, this restlessness, this craving for mental excitement, this emotional prodigality, this over-absorption in business cares, this over-hurrying and over-worrying which in a thousand forms is exemplified in the lives among which we live. It is certainly timely and proper to call a halt in this mad rush, to make haste more slowly and more wisely for a while, to gain time for a survey of our surroundings and a searching for the best means of adapting ourselves to them,—of getting the most and the best of life, if you will, but without losing the power to enjoy in the very strife for those things by which our pleasure is to be gained.

It is also well to recognize, as the present volume clearly does, that this problem is to be solved by mental and moral discipline quite as much as by physical; or, rather, that the two are in so many respects one. Control over the body is mental control. Right use of body comes through mental health. The modern view of the relation between body and mind finds its support quite as plentifully in the field of disease as in that of normal action. The necessity of treating the two together in order to gain an insight into the nature of the activities whereby we live and move and have our being, is no more cogent than it is in the study of diseased function. It is the psycho-physical organism that we educate, it is the psycho-physical organism that we cure.

But the ways and means of avoiding this mental break-down, this nervous prostration, — what of these? As to the efficacy of the author's answer to this practical question, there will be many opinions. The treatment is elaborately though not always clearly described; but the essence of it is to bring into consciousness the motor evidences of our mental strain, the little nervous twitchings and habits that have so deep a hold on all of us. We must learn to be passive, to utilize the many opportunities of rest that occur. When we sit in a chair, we must sink into it, trust in it, and let it hold us. In riding, we must not worry about how fast we are going: we must relax all the muscles, and gain power through repose. Our position in sleep must be as unconstrained as that of a child. When called upon to endure pain, we must yield to it and have it over, not restrain and check with the risk of a disastrous explosion later. If we have so far strayed from the path of physical rectitude as to be oblivious of our erring state, we have a course of special exercises prescribed for restoring the consciousness of our faults, and all this applies as well to mental as to bodily habits.

While agreeing with the desirability of the end to be secured, and in certain cases the utility of the steps prescribed, we cannot but question whether our author is not mistaking a symptom for a cause, and is treating but one factor of a much more complex ailment; whether, too, her enthusiasm does not overestimate what can be done by will alone. This is not, however, a "faddist" work (although Delsarte is mentioned more than once): it is a serious statement of a serious problem. The remedy, however suggestive, is certainly incomplete. There are many whom the reading of this work and the obedience to its advice will greatly benefit, and it goes out upon its mission with the well-wishes of all interested in securing and maintaining mental and physical health.

Wörterbuch des Runa Simi, oder der Keshua Sprache. Von Dr. E. W. MIDDENDORF. Leipzig, 1890. 8°.

Das Runa Simi oder die Keshua Sprache, wie sie gegenwärtig in der Proving von Cusco gesprochen wird. Von Dr. E. W. MIDDENDORF. Leipzig, 1890.

Ollanta, ein Drama der Keshua-Sprache. Uebersetzt von Dr. E. W. MIDDENDORF. Leipzig, 1890.

Dramatische und Lyrische Dichtungen der Keshua-Sprache. Gesammelt und uebersetzt von Dr. E. W. MIDDENDORF. Leipzig, 1891.

IT is, we believe, without precedent to find nearly two thousand pages, printed within one year, devoted to the literature of a single American language. This is the extraordinary task which Dr. Middendorf set before him, and which he has admirably accomplished.

The Kechua, known locally as the *runa simi* (or "language of the people"), is that spoken by the distinctively Peruvian stock, and, next to the Nahuatl of Mexico and the Maya of Central America, offers the most extensive literary remains of any American tongue. During a residence of five and twenty years in Peru, Dr. Middendorf pursued its study with zeal, and collected all the fragments of its literature which he learned about. These, together with a grammar and dictionary, both well prepared, are included in the volumes before us.

First among these fragments should be placed the Ollanta drama, which had already been edited and translated into German by Von Tschudi, into English by Markham, into French by Pacheco Zegarra, and into Spanish by several authors. All these have leaned to the opinion that it was a native composition dating from before the conquest; but Middendorf gives various reasons for regarding it as a much later production, though probably based on an authentic aboriginal play. He also gives the full text, with translations, of two Kechua sacred dramas, — "The Lost Son," and "Usca Paukar," — written undoubtedly by natives, and therefore correct specimens of the language, though, of course, later than the conquest. To these he adds a number of poems and prose writings, thus furnishing a very satisfactory mass of material for the study of the tongue in both its ancient and modern form.

While we have nothing but praise for these features of his work, we must lower the note in speaking of his remarks on the laws, customs, and culture of the ancient Peruvians. It is clear that on these branches he has not studied the best authorities, and is far from understanding accurately the state system of the Incas. No one has analyzed this so well as our fellow-countryman, Dr. Gustav Brühl of Cincinnati, and it is to be regretted that Dr. Middendorf did not acquaint himself with the writings of that able Americanist.

The works we have named at the outset are but a part of the praiseworthy plan which Dr. Middendorf has announced. He intends to follow them in rapid succession with as complete an exposition of the languages and literatures of the Aymaras and the Yuncas (or Chimus), the two other semi-civilized nationalities of ancient Peru. We congratulate him on his enthusiasm and enlightened devotion to this neglected branch of human learning, and hope that his efforts will meet with liberal encouragement in this and other countries.

The Historic Note-Book. By E. COBHAM BREWER. Philadelphia, Lippincott. 8°.

MR. BREWER, who had previously given to the public several small cyclopædias, now offers another of a somewhat different character. It is not a dictionary of dates, nor is it an alphabetical list of the main events of history: on the contrary, the main events are for the most part ignored or lightly treated. It is, as the author himself says, "not an historic dictionary, but a dictionary of historic terms and phrases, jottings of odds and ends of history, which historians leave in the cold or only incidentally mention:" hence it contains a great many items that would be hard to find in the ordinary histories or cyclopædias. Some of these items are political, others religious and ecclesiastical, while others still relate to literature, art, commerce, and various other topics. Kings and other prominent personages also claim a share of attention, and the book contains many interesting and amusing anecdotes. Sometimes, as in the articles on "Council," "Constitution and Massacre," a good deal of useful information is conveyed; and there is an appendix containing a list of the more important battles. We noticed, as we looked the book over, some inaccuracies; as, for instance, the statement that Harvard College was founded by John Harvard, and the statement in the article on "Languages" that German is spoken by a hundred million people. Some of the author's remarks on political matters are not in good taste, being too strongly tinged with partisanship; but the book will be useful to students of history and literature, and will give them a good deal of information not readily accessible elsewhere.

Zoölogical Articles contributed to the Encyclopædia Britannica. By E RAY LANKESTER, W. J. SOLLAS, A. A. W. HUBRECHT, L. VON GRAFF, A. G. BOURNE, and W. A. HERDMAN. New York, Scribner. 4°. $5.

THE title of this volume is misleading, as there is extremely little zoölogy in the articles contained in it; at least, in the sense in which the term "zoölogy" is now most commonly used. It is really a series of summaries of the views on the morphology of the groups enumerated, which, at the time of publication, were held by the contributors. The articles, which appeared at intervals between 1880 and the end of 1888, following the alphabetic order of the volumes in which they were originally printed, comprise *Hydrozoa*, *Mollusca*, *Nemertines*, *Planarians*, *Polyzoa*, *Protozoa*, *Rotifera*, sponges, *Tunicata*, and *Vertebrata*. The later articles are, of course, those which the subsequent progress of science has least outstripped. Those by Messrs. Herdman, Hubrecht, and Von Graff, since the writers are recognized authorities on the topics assigned them, would, in any event, represent a very high standard of opinion. The older articles, especially that on the *Protozoa*, by no means represent the present state of scientific opinion; while that on the *Mollusca*, as shown in these columns at the time of its original publication, was an extremely imperfect production. Over its hazardous speculations time had thrown a kindly mantle, until this reprint recalled them to the glimpses of the moon. Even Professor Lankester now admits, in view of the testimony offered by one of his pupils, that naturalists from Cuvier to Fischer were right in separating, and that he was wrong in uniting, the pteropods and cephalopods, something which not over half a dozen persons have ever doubted.

But it would be unfair to the authors, and to those who might be able to profit by this volume, to insist too strongly on the defects or deficiencies of these papers. It being once understood that the papers are almost exclusively morphological, and represent the opinions of Professor Lankester and the school of which he is the recognized exponent, biologists generally will require no further guide to the quality of their merits or shortcomings.

For the lay reader or youthful and inexperienced student, this book is undesirable. Only those thoroughly familiar with the branches to which it refers can get a full measure of profit out of its mingled science and speculation. To others it must prove confusing. But it will be welcome to the library of the morphologist and specialist; useful, through its bibliographies, to those who would refer to previous morphological literature; and, in some instances, may serve as an "awful example" to those whose tendency to speculate outruns their knowledge of the subject.

It is handsomely printed, but the absence of an index is a fault for which, under the circumstances, it seems difficult to account.

Publications received at Editor's Office, April 6-18.

AVELING, E. An Introduction to the Study of Botany. London, Swan Sonnenschein & Co. 363 p. 12°. (New York, Macmillan, $10.)
BAILEY, L. H. The Nursery-Book: A Complete Guide to the Multiplication and Pollination of Plants. New York, Rural Pub. Co. 304 p. 12°.
GAY, G. E Business Book-keeping. Boston, Ginn. 93 p. 4°. 75 cents.
LOWELL, P. Noto, An Unexplored Corner of Japan. Boston and New York, Houghton, Mifflin & Co. 261 p. 12°. $1.25.
MASSACHUSETTS. Examinations by the State Board of Health of the Water Supplies and Inland Waters of, 1887-90. Part I. Report on Water Supply and Sewerage. Boston. State. 857 p. 8°.
TEALL, F. H. The Compounding of English Words. New York, John Ireland. 223 p. 12°. $1.25.
WILSON, J. V. How to Magnetize; or, Magnetism and Clairvoyance. New ed. New York, Fowler & Wells Co. 104 p. 16°. 25 cents.

AMONG THE PUBLISHERS.

JOHN WILEY & SONS announce as in preparation "The Transition Curve Field-Book," by Clinton R. Howard, C.E.

— John Wiley & Sons announce as in preparation "The Mechanical Engineer's Pocket Book," by William Kent.

— Sister Rose Gertrude has written another article for *The Ladies' Home Journal* for June, on "What it is to be a Leper," in which she gives a clear glimpse of leper-life in Molokai, how the disease is contracted, how it is treated and cured, and how the lepers live in their exile.

— D. C. Heath & Co. have in press for early publication an "American Literature for High Schools and Colleges," by Julian Hawthorne and Leonard Lemmon; also "French by Reading," a new French method on the inductive plan, by Louise Seymour Houghton and Mary Houghton.

— Among their books in press, J. B. Lippincott Company announces "The Chemical Analysis of Iron," by Andrew Alexander Blair (new edition); "A Hand-Book of Industrial Organic Chemistry," by S. C. Sadtler; "Tables for the Determination of Minerals," by Persifor Frazer, jun. (new edition, revised and enlarged); "Chambers's Encyclopædia," Vol. VII. (entirely new edition, revised and rewritten).

— Messrs. Macmillan & Co. will publish next week a "Short History of Greek Philosophy," for students and general readers, by Dr. John Marshall, rector of the Royal High School, Edinburgh. The main purpose of this book is to present an account of Greek philosophy which, within strict limits of brevity, shall be at once authentic and interesting,— authentic, as being based on the original works themselves; interesting, as presenting to the ordinary English reader the great thoughts of the greatest men of antiquity, on problems of permanent significance and value, in language freed from technicality and abstruseness.

— T. Fisher Unwin has nearly completed preparations for a "History of the Press." The volumes will deal in the first place with the British press, and afterwards with the continental press and the American. In each case the history of the great journals will be treated in connection equally with the political and social events they have influenced, and the characters and methods of the men who have directed them to these ends. In a few instances a single journal has played a sufficiently conspicuous and important part to furnish abundant materials for a single volume, but in others the general characteristics of a section of the press will combine many newspapers and personalities into one work. The first volume will be devoted to the *Times*, and others have been arranged to treat of "The Provincial Press," "The French Press," "The German Press," "The American Press," and "The Comic Press." The volumes will be issued under the general editorship of Mr. Henry Norman.

— "Spinning Tops" is an interesting and valuable addition to the Romance of Science Series, published in London by the Society for Promoting Christian Knowledge, and in this country by E. & J. B. Young & Co. The volume is an expanded revision of an "operatives' lecture," delivered by Professor John Perry at the British Association meeting at Leeds in 1890. The changes necessitated by the conversion of a lecture illustrated by actual experiments with elaborate apparatus, into a treatise illustrated by engravings and explanatory letterpress, have been carefully made; and the result is a volume that will not only interest the general reader, but also add considerable to his knowledge of some branches of science. Beginning with a description of the behavior of a spinning top, the author goes on step by step to the movements of the earth in space, touching incidentally on the connection between light and magnetism, and the rotation of the plane of polarization, making his points clear at each step by means of apparatus adapted to the purpose.

SCIEN[redacted]E

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NINTH YEAR.
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NEW YORK, MAY 1, 1891.

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CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

April 25. — On the Characteristic Radiate Growth in Acid Lavas (illustrated by specimens); Whitman Cross, Constitution and Origin of Spherulites; J. P. Iddings, Spherulitic Chrystallization in Obsidian; R. S. Woodward, A Review of Tisserand's "Traité de Mécanique Céleste."

New York Academy of Sciences.

April 27. — Henry M. Parkhurst, Stellar Photometry.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—Vols. I and II. of Allen's "Commercial Organic Analysis." SCIENCE BOOK AGENCY, 47 Lafayette Place, New York.

THERE is an opening in this office for a college graduate with scientific tastes. *Science*, 47 Lafayette Place, New York.

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A HARVARD M A., especially interested in Natural History, would like to learn of some outdoor occupation for the summer. Remuneration a secondary object. SUMMER, *Science* Office.

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WANTED—A position to teach Electrical Engineering by a student from leading English and French and U. S. science schools, or would accept position as Consulting Electrical Engineer, Electrician, etc. Very highest testimonials London & Hartford Publishing Co., N. Y. (International Press Department.)

WANTED.—A young man in college would like a position during the summer of 1891 in some scientific work, particularly Orinthology, either as an instructor or tutor, or in making collections or accompanying some scientific expedition. Can give good references. Address HUBERT L. CLARK, Amherst, Mass.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

Will exchange a new Thomson reflecting astatic galvanometer, about 6,000 ohms, made by Clark, Muirhead & Co., London, and costing £30, with 1-9, 1-99, 1-999, shunts, lamp and scale, for a Weston voltmeter and ammeter, or large Wheatstone bridge, dial pattern, or a portable testing outfit. Address G. A., *Science* Office, 47 Lafayette Place, New York.

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

I have a good supply of Eastern Coleoptera which I wish to exchange for species not in my collection. Melandryidae and Oedemeridae especially desired. Joe C. Thompson, Rosebank P. O., Box 73, S. I.

SCIENCE.

NEW YORK, MAY 1, 1891.

RECENT PROGRESS IN SOLAR PHYSICS AS BEARING UPON THE CAUSE OF THE ICE AGE.

AMONG the many hypotheses invoked to find an adequate cause for the glacial period, that of a time of diminution of the sun's emission of heat has had little consideration. Although apparently naming a cause adequate to the effect, it seemed too violent an assumption, and one opposed to generally accepted fact, that the supply of heat from the sun could vary to any material amount. The universal conception of the solar orb and its activities was that of extreme steadiness and uniformity of behavior, as being almost an emblem of immutable law. Any change or abatement in the sun's energy in supplying heat and light seemed as foreign to a proper notion of that body as would be a deviation from punctual rising and setting as laid down in the almanac.

Hence, in the presence of the brilliant and imposing astronomical theory of Dr. Croll, the more obvious hypothesis of solar variation lapsed out of sight. Of late, however, the former theory is becoming discredited by the growing clearness of evidence that the ice age was too recent to be accounted for thereby. The rates of recession of the Niagara gorge and of the falls of the Mississippi render it difficult to account for a continental glacier still existing seven thousand years ago, by an eccentricity of the earth's orbit which occurred fourteen times as far back in the past.

During the quarter-century since Dr. Croll's theory came into vogue, our knowledge of solar physics has been enormously developed and quite revolutionized. Possibilities and probabilities as to the variability of the sun's emission of heat are now well known, which then were not even matters of vague conjecture. Inspection of the structure and activities of the sun by means of the spectroscope has wholly changed the former conditions for reasoning about its variability.

The most conspicuous result of this spectroscopic inspection is our knowledge that the sun exhibits the most violently energetic activity all over its surface, far into its depths, and far outside of the photosphere. It continually generates and radiates into space almost inconceivable floods of light and heat. This is attended by intensely violent ebullition at the surface, in which vast streams of fluid matter are constantly flung aloft tens and hundreds of thousands of miles above the photosphere. The most titanic eruptions of earth, such as Krakatoa, are, when compared with those hourly occurring in the sun, far less than the dust-whirl of the street is to the tornado that wrecks a city.

I adduce this fact of violent ebullient activity in the sun as lending a presumption of more or less inequality in that activity. It gives the impression of contending forces arrayed against each other, necessarily disturbing equilibrium, and forbidding an equable and uniform emission of light and heat. Such inequality is markedly indicated by the known periodicity of the cyclonic sun-spots, and their attendant cosmic magnetic disturbances. There still lack results of actual observation to verify the fact of such fluctuation. The younger Angström of Sweden is understood to be now conducting delicate observations with this intent.

A vastly more extended area for observation and classification of facts relating to solar physics has been opened in the new department of stellar spectroscopy in which Dr. Norman Lockyer is the worker best known to the public. By the classification of the spectra of many hundreds of fixed stars and nebulæ, a series of grades of solar evolution have been approximately determined, beginning with suns incipiently gathering from diffused nebulous matter, and going on through successive stages of accumulation, concentration, intensifying heat, culmination, decline, and approaching extinction. All these stages are determined and classified by the peculiarities of their spectra. Dr. Lockyer is thus enabled to write approximately the history of a sun from its earliest genesis to its extinction as a luminary. Our own sun has been definitely assigned by the character of its spectrum to a class of stars of decreasing temperature, which have passed the culminating point of their activity, and are going on towards decline, like Procyon, Capella, and Arcturus. Aldebaran, Altair, and Alpha Cygni are examples of another class approaching their culmination, and increasing in brightness. Sirius is in a still earlier and more vaporous stage.

While the known violence of the sun's internal activity is suggestive of frequent transient variations in the amount of heat emitted, the above named long progressive changes are equally suggestive of vast secular oscillations in the course of the increase and decrease observed. It seems, indeed, quite impossible that those long-continued progresses of increase and subsequent decline in the heat and light of solar orbs should go on with absolute uniformity of gradation. All such processes of active change in nature are characterized by fluctuation, by alternating ebb and flow; and such a process as this would be the last to show an exception to the rule. It involves a continual balancing of mighty contending forces, forever swaying the resultant thermal condition up and down with varying divergence from an even grade of increase or decrease.

It is only in harmony with the universal laws of material activity — and it is nearly impossible to conceive it otherwise — that the heat of the sun, as it slowly diminishes through the ages, should at intervals make strong sweeps upwards or downwards, again recovering itself to its average grade of slow decline, rather than that it should progress in a uniform and imperceptible diminution. It thus seems in the highest degree probable that the sun is subject to considerable secular variations in its heat, such as might have caused the glacial period, as well as the just preceding age of arctic warmth.

As observed above, the enormous violence of the sun's internal movements, which is actually seen to exist, seems necessarily to involve fluctuation in its effects. Such opposing energies cannot uniformly so balance each other as to produce a uniform emission of light and heat. An enormous expenditure of force is going on with the progressive condensation of the vast orb. Volumes of heat and light inconceivably great are being every instant shot forth and dis-

tributed into boundless areas of space. All this is supplied by the contraction of the sun's bulk. It is in place now to specify some of the interacting and counteracting forces involved in this process of shrinkage of diameter and radiation of heat. We shall more clearly see causes of inevitable disturbance of equilibrium in the constantly varying energy of the different factors which play unequally against each other.

Every atom of the solar orb is being continually drawn towards its centre by the gravitation of the sun's own tremendous mass; but this tendency is resisted by the intense heat, which causes each particle to repel its neighbor, and so to prevent and delay that condensation to compact solidity which is to be the ultimate result. Heat must be parted with before the strenuous behest of gravity can be obeyed. Thus the process of contraction goes on with extreme slowness, only by means of, so to speak, the squeezing-out of immense volumes of heat from the whole mass. The result is an imperceptible contraction of bulk, leaving the sensible heat practically undiminished, although latent heat has been copiously expended. The heat thus continually released, and oozing from every molecule throughout the bulk of the mighty orb, finds escape from the interior to the surface by means of vast upboiling currents of superheated fluid which carry out the heat; in other words, by the process of convection.

Now observe the elements of variation as found in the interacting forces involved. The primary factor in this combination is the force of gravitation; but gravitation must increase inversely as the square of the sun's radius. As the bulk shrinks, gravity multiplies. When the sun had twice its present diameter, its particles drew together only one-fourth as hard as they do now. Here, then, is a steadily changing factor tending to disturb the uniformity of the heat emitted.

A second ever-changing factor is the area of the radiating surface of the photosphere. This varies, not inversely like gravitation, but directly as the square of the sun's radius. When the sun was twice its present diameter, the area of its photosphere was four times as extensive: in other words, the heat had four times as wide a gate to find escape through. This, again, tends to disturb uniformity in the emission of heat.

A third element of variation is to be found in molecular repulsion, which varies not only with the amount of sensible heat, which is possibly still rising as the sun grows denser, but it will also vary as the square of the decreasing distances between the crowding molecules. This influence is opposed to that of gravitation, and tends to prevent condensation. This varying quantity constitutes a third antagonist in the fray, as the war sways to and fro in the sun's interior.

A fourth factor is the slowly lessening distance from the sun's centre to its surface, which facilitates the transit of the outgoing currents conveying to the surface the superheated fluids of the contracting interior. As the sun shrinks, the path to the surface shortens directly as the radius, thus tending to increase the escape of heat.

But counteracting this is the increasing density of the sun's contents, which varies inversely as the cube of the radius; that is, as the shrinkage of bulk. The mass of the sun is now eight times as dense as when of twice its present diameter. This greatly increases the resistance to movement of internal currents, just as one hundred people in a hall of a given size will move about more than twice as easily as two hundred people in the same hall who crowd and jostle each other.

A sixth and perhaps very variable factor which powerfully retards the radiation of light and heat, is the enveloping atmosphere of the sun, estimated at several thousand miles in depth, and of considerable density. This atmosphere, like an enswathing blanket, arrests a large portion of the radiated heat. Now, the quantity of this atmosphere being assumed as constant, its depth will tend to vary inversely as the area, that is, as the square of the sun's diameter, and so the radiation of heat be hindered increasingly as the sun shrinks.

It is quite impossible, however, that the quantity of atmosphere outside of the photosphere should remain exactly constant. Large quantities are evidently carried down into the sun's interior by the plunging rush of the sun-spot vortices, no doubt to boil up again to the surface.

Added to the regular atmosphere are the red cumulus protuberances above the atmosphere, composed of more tenuous vapor forced out perhaps by electric repulsion. These must contribute to arrest the escape of heat, and are also variable in quantity.

This brings us to another probable element of a perturbing nature in its influence upon the escape of heat; that is, electrical repulsion. It is probably this which not only drives forth the red protuberances to such an enormous height, but which also shoots out the broad streamers of the sun's corona. The tails of comets are probably forced outwards by a similar repulsion from the sun.

As this force is habitually attendant upon molecular activity and the generation of heat, it must be subject to considerable fluctuation with the violent internal agitation of the orb. To all this fluctuation the earth's magnetism constantly responds, like a delicate galvanometer. How much more powerfully, then, must the sun's own atmosphere respond, dilating and bristling out with every rising wave of electrical agitation! Such dilatation of the atmosphere and its vast appendages cannot fail to diminish the radiation of heat, like a bird roughing its feathers in the cold.

Miss Agnes Clerke describes those stars in the same class as our sun as being more strongly electrified than the others, and hence likely to be more active in their fluctuations of repelling force.

Recent developments in chemical science promote belief in the existence of elementary forms of matter not yet actually observed. Certain peculiarities in the spectrum of the sun are thought to indicate that much of its matter is still in such elementary forms, owing to its intense heat. This increases the probability that great chemical processes are going on in the sun, which are attended with evolution of heat, and which thus contribute to the complexity of causes producing variation thereof.

Should we adopt the conjecture of Mr. Proctor and others, that the supply of heat in the sun is largely maintained by a bombardment of meteorites supposed to be densely swarming about it, we might find in this another element of variation. This is, however, hardly more than unsupported conjecture.

The foregoing enumeration of certain and probable factors in the sun's internal activity, as contributing to produce much variation in the resultant emission of heat and light, is necessarily but rude and imperfect; yet at least it serves to illustrate and lend probability to the hypothesis advocated in this essay. Some of the causes of fluctuation named seem most adapted to produce comparatively brief and transient inequalities of radiation, such as might easily be verified by long-extended instrumental measurements in elevated posi-

tions. It seems not unlikely that the greater part of the meteorological perturbations of our globe will be found closely connected with such transient inequalities in the sun's activity.

Some of the factors concerned seem, however, more adapted to produce secular oscillations in the sun's evolution of heat, extending through periods like the thousands of years probably occupied by the glacial age, and by the antecedent age of arctic warmth.

The one impossible thing would seem to be that the conflict of all those struggling and discordant forces should generate such an equalized and perfected balance in their resultant, that the sun's emission of light and heat should continue uniform and undisturbed from age to age; that it should not, indeed, from time to time be subject to very great fluctuations. In this view of the question, it seems not unreasonable to claim at least a place of high consideration for this hypothesis among other unverified hypotheses of the cause of the glacial period.

It may be claimed in favor of this hypothesis that it serves to account for the antecedent age of arctic warmth, as well as for the glacial age. Dr. Croll's hypothesis wholly failed in this respect. Nor, as it occurred not earlier than the pliocene, can it be attributed to conditions belonging to the carboniferous period.

As an objection to the solar hypothesis, it has been alleged that a diminution of solar heat would forbid the evaporation required to supply a precipitation of snow adequate to form glaciers. To this it may be replied that existing glaciers, like that of Greenland, are by no means supplied from the copious evaporation of the tropics, which is all precipitated in the neighboring latitudes. They are fed from the far lesser evaporation of the neighboring open seas, including the extremities of the Gulf and Kurasiwo currents. It is estimated that a general reduction of temperature of 18° to 20° F. over the earth's surface would produce the glacial period. Even with such a reduction in the sun's supply of heat, a large evaporation would continue, as well as air and ocean currents distributing the reduced warmth. The necessarily resulting changes would not involve a suspension of evaporation and precipitation, but rather a transfer of the areas of glaciation from the arctic to the temperate zone, such as actually took place in the glacial age.

SERENO E. BISHOP.

THE CULTIVATION OF THE SUGAR-BEET IN OHIO.

"FARMERS' BULLETIN No. 3" of the United States Department of Agriculture is an abridgment of a monograph on the sugar-beet, recently compiled by Professor H. W. Wiley, chemist of the department.

Judging from European experience, it seems probable that the culture of the sugar-beet in America will be most successful within the limits of a belt of about one hundred miles on each side of the summer isotherm of 70°; that is, a line marking an average temperature of 70° for the months of June, July, and August. In Ohio this line follows approximately the southern shore of Lake Erie, so that the northern third of the State is included within the belt named.

The summer temperature is not the only climatic question that must be considered, however; as, for instance, the mild winters of southern California permit the piling of the beets in immense heaps, requiring no protection, or, at most, but a slight covering of straw, and thus extending the working season throughout the winter; whereas in northern Ohio the beets would have to be pitted or housed in expensive cellars or silos. Again, the California winter gives a season of three or four months during which planting may be done, or three times as long as in northern Ohio.

The soil most favorable to the culture of sugar-beets is one that is easily worked, and is fertile enough to produce rapid growth. The moderately sandy soils, and especially the black sands of northern Ohio, will probably be found well adapted to beet-culture. The fertile bottom-lands of the farm occupied by the experiment station at Columbus produce large crops of beets. Stiff, heavy clays will not be found satisfactory, as a rule, unless thoroughly underdrained and brought up to a high state of fertility by previous manuring and the growth of clover.

The variety of beet is an important point, but a yet more important one is the care with which the seed has been selected. In France and Germany the percentage of sugar in the beet has been very greatly increased by improvements in the production of seed.

The manufacture of sugar from beets involves the use of very expensive apparatus, and requires great technical skill. In 118 German factories the mean capital invested in each factory is nearly two hundred thousand dollars; and the total expense of manufacture is nearly eight dollars per ton, counting the beets at a little less than five dollars per long ton. The experience of the Ohio Experiment Station is, that, on suitable soils, beets can be raised at this price with a very wide margin for profit.

The bulletin referred to contains illustrations of machinery used in beet-culture, and many other interesting items which cannot be condensed into a brief abstract. The station has received a few copies of this bulletin for distribution in Ohio, and will take pleasure in sending them free of all costs to all applicants, while the supply lasts. Address Experiment Station, Columbus, O.

NOTES AND NEWS.

AN exhibition of all the means of advertising will be held at the Palais des Beaux-Arts, Champ-de-Mars, Paris, from May 17 to Sept. 15.

— For a year past, the crater of Halemaumau, in the volcano of Kilauea, Hawaii, has been in a state of high activity, the lava frequently pouring out through ducts upon the main floor of Kilauea. On March 5 sinking began, attended with slight earthquakes, extending into the neighboring district of Kau. By the 8th the collapse was complete. The interior cone, with the adjacent fire-lakes, had sunk out of sight; and the entire area of Halemaumau, over half a mile in diameter, is now occupied by a pit estimated at five hundred feet in depth. It was just five years after the last and similar collapse. As then, no fire is now in sight. Some fissure has opened in the side of the main column of lava, and discharged the contents under ground. It is perhaps not a mere coincidence that on March 4 the mercury in Honolulu reached the lowest point on record, 48°. The extreme cold of March 10 in England will be noted in this connection. A full report of the condition of Kilauea is expected from Professor Brigham, who is now on the ground.

— The forthcoming May number of the *Review of Reviews* contains, under the title "Three Empire Builders," some timely character sketches. One deals with Sir Henry Parkes, prime minister of New South Wales, the father of Australian federation, and chairman of the great constitutional convention which has just concluded its labors at Melbourne. Another deals with Sir John Macdonald. The third sketch has the Hon. Cecil Rhodes for its subject, Mr. Rhodes being the gifted young Englishman who, a few years ago, went out as a consumptive student from Oxford to regain his health in Africa, and who has been conquering a new empire for Great Britain with Capetown as its capital. Among the special features of the May number will be found an article entitled "Workingmen's Clubs vs. The Bar-Room." "The Progress of the World," an editorial department of the *Review of Reviews*, contains in the May number a map of Australia showing the newly federated provinces, several maps showing the course of the new Nicaragua Canal, and various portraits.

— At a meeting of the trustees of the Johns Hopkins University, held April 6, 1891, the president of the university stated that a lady in New England had authorized him to offer the university the sum of five hundred dollars, to be bestowed in annual prizes during the next ten years, under the following conditions: the

prize shall be awarded for the best essay written by a graduate student upon some subject in historical or political science, ancient or modern, and submitted by him or for him to the academic council. The prize shall consist of a bronze replica of a likeness of Chief Justice Marshall, together with printed copies of his decisions (if they can be obtained). The prize shall be known as The John Marshall Prize of the Johns Hopkins University. To indicate the character of the work which the donor desires to encourage, she requests that three copies of the likeness be given as prizes for three essays to be selected by competent judges from the essays already published by recent members of the university. She desires that the further regulations for the bestowal of the prize shall be made by the president of the university, with the concurrence of the academic council. If, at the end of ten years, any balance shall remain unexpended, it shall be devoted by the trustees to the continuation of the prize, or to any other object that they may select.

— An expedition into southern and eastern Maryland has been organized, through the co-operation of the Johns Hopkins University, the United States Geological Survey, and the Maryland Agricultural College. The project has been approved by the governor and Board of Public Works of the State, and one or more steamers of the Maryland Oyster Navy will be detailed for the accommodation of the members of the expedition. The object of the expedition is to study the natural resources of the southern and eastern portions of the State. The heads of the Johns Hopkins University, the United States Geological Survey, and the State Agricultural College have designated the following persons as a board of control: Professor W. B. Clark of the Johns Hopkins University, chairman; Professor Milton Whitney of the State Agricultural College, secretary and treasurer; Mr. W. J. McGee of the United States Geological Survey. The expedition was to leave Baltimore April 23.

— Among the results already obtained from the oceanographic expedition of the "Pola," organized by the Academy of Sciences of Vienna, are the following, as we learn from *Nature* of April 16: The water of the central basin of the Mediterranean was found to be warmer, denser, and richer in dissolved salts, than the western basin. As regards the penetration of light into the sea, a white disk was visible only at a depth of 43 metres, but photographic plates were affected at a depth of 500 metres. Starting from the surface of the sea, the quantity of oxygen dissolved at first increases with the decrease of temperature, but then again decreases, so that at a depth of 3,000 metres the proportion is the same as that at the surface. In no case was any free carbonic acid found. The nitrogenous substances in solution vary in inverse proportion to the depth: that of ammonia varies but slightly, but is greater in the lower strata.

— The next annual meeting of the Royal Society of Canada will open in Montreal on Wednesday, May 27, 1891. The sessions usually last one week. It is anticipated that the meeting will be attended by many distinguished persons eminent in literature and science from Europe and the United States as well as from the Dominion of Canada. The ordinary sessions of the society will be held in the buildings of the McGill University, and the popular evening lectures will be delivered in the Queen's Hall on St. Catherine Street. The museums and art galleries, with the educational, industrial, and other institutions of the city, will be opened to visiting members and associates. Local excursions to places of interest in the neighborhood will be arranged for; and receptions, garden-parties, and entertainments of various kinds, will also be provided. To members and associates attending the meeting, the Intercolonial Railway of Canada will issue return tickets over its system at a single fare. The Grand Trunk and the Canadian Pacific Railways, together with their connecting railways in the United States, will issue similar tickets at a fare and a third for the double journey. The committee are engaged in the preparation of a handbook, for gratuitous circulation among intending visitors, which will include an historical account of the society, together with other interesting scientific and local information, a copy of which will be sent on application. It will greatly facilitate the arrangements of the committee if intending visitors will promptly advise the local secretaries, 32 University Street, Montreal, of their intention. All persons interested in literature and science may become associates for this meeting, and are cordially invited by the local committee to be present thereat.

— At a meeting of the Royal Meteorological Society, April 15, the following papers were read: — "Some Remarkable Features in the Winter of 1890–91," by Mr. F. J. Brodie, in which the author points out the peculiarities or special features of interest in the weather which prevailed over the British Isles during the past winter, and states that in addition to the prolonged frost, which lasted from the close of November to about Jan. 22, he finds that the barometric pressure for the whole winter was about a quarter of an inch above the average, and that when the wind was not absolutely calm there was an undue prevalence of breezes from some cold quarter; that the percentage of winds from the southward did not amount to one-half of the average, the number of foggy days in London was no less than twice the average, and the rainfall over the greater part of the British Isles was less than half the average; that "almost every element in the weather has been influenced to an abnormal degree by the remarkable prevalence of high barometrical pressure, and, if we were called upon to define the season 1890–91, we should have little hesitation in giving it the name of the 'anticyclonic' winter:" "The rainfall of February, 1891," by Mr. H. S. Wallis, in which the author states that this was one of the dryest months upon record, the mean rainfall over England, excluding the Lake District, being only .066 of an inch, or about one-fortieth of the average: "On the Variations of the Rainfall at Cherra Poonjee in the Khasi Hills, Assam," by Mr. H. F. Blanford, in which it is stated that Cherra Poonjee has long been notorious as having a heavier rainfall than any other known place on the globe, the mean annual fall being frequently given as about 600 inches. Mr. Blanford has made a critical examination of the various records of rainfall kept at this place, and has come to the conclusion that the above amount is too high, and that the average annual rainfall is probably only a little over 500 inches.

— The "Hopkins House of Commons," founded in 1884 under the impulse given by Professor Woodrow Wilson, and for some years a very popular organization of Johns Hopkins University, has been revived. A preliminary gathering was recently held, and it was determined to continue the society by obtaining as many new members as possible, and resuming regular sessions. Four meetings have now been held with an average attendance of about twenty-five, and it is hoped that the success of the organization is assured. Both graduates and undergraduates are eligible to membership, and the meetings are open to visitors. They are held in College Hall at 8 o'clock every Monday evening.

— An attempt is to be made to establish an engineering laboratory at Cambridge University (England) on the model of those at the Central Institution, Kensington, and at University College, Liverpool. The syndicate appointed to consider the question report that "the study of mechanics gains much in utility, and loses nothing in educational value, by being approached from the standpoint of the engineer." "This is an important admission," says *Engineering* of April 17, "as the unfortunate engineer has had to stand any quantity of abuse from physicists, such as Professor Lodge, because he does approach these matters from his own standpoint, and works with quantities he understands, and measures daily, such as weights rather than masses, and pounds per square inch instead of dynes per square centimetre. Professor Greenhill, who is an old Whitworth scholar, has, it is true, supported the engineers; but many physicists seem to consider him as more or less of a traitor who profanes their mysteries, in making them intelligible to the practically trained man. Apart from this, however, every one will agree with the dictum of the syndicate quoted above. The abstract ideas of the mathematician become concrete entities in the practice of the engineer, and both pure and applied physics should benefit from the establishment on a proper scale of an engineering laboratory at Cambridge. The principal difficulty is one of money. A sum of $100,000 is required; and, Cambridge not being a large business town like Liverpool, there is no one there able to imitate the generosity of Sir A. B. Walker at the

latter city. Still, among the alumni of the university there are so many wealthy men who should be proud to come to the assistance of their alma mater. The university have out of their present funds provided a suitable site, and have provided annual grants towards the payment of demonstrators and the current expenses of the department. More, however, they are unable to do, without outside assistance, which, it is to be hoped, will be promptly forthcoming."

— We learn from *Engineering* that the Kew Observatory are about to undertake the testing of photographic lenses, as they have long done that of telescopes, sextants, and surveying instruments, as well as watches and thermometers. Lenses up to four inches in diameter will be examined, and certificates awarded according to the performances of the glass. They will be tested in sets, the trials beginning about the 1st and 15th of each month. A lens may be entered either for a class A certificate or a class B one. In the first case, the fee for which is 10s. 6d., the test will comprise the determination of the length of equivalent focus; size of effective aperture with every stop in terms of focal length; angle of field of view and size of plate effectively illuminated; number of external reflecting surfaces; coincidence of visual and chemical foci; presence of flare spot; workmanship of surfaces, structure and degree of transparency of glass; centring in mount; defining power; relative quality of illumination in different parts of field, and amount of astigmatism or optical distortion. For a class B certificate, at a fee of 2s. 6d., the test will consist simply of the determination of the length of equivalent focus; size of effective aperture with largest stop; angle of field of view; size of plate effectively illuminated; and coincidence of visual and chemical foci. Further particulars of the arrangements can be obtained from the superintendent, Kew Observatory, Old Deer Park, Richmond. The fees charged are certainly very moderate for the work undertaken, and, from the character already earned by the officials of the Kew Observatory, there can be no doubt that this work will be thoroughly performed.

— In the course of excavations which are being carried out in the neighborhood of Vienna by the Academy of Sciences, a cavern was discovered on the slope of the mountain at Baden. A correspondent writes to the London *Times*, "It was plain, on a cursory inspection, that the cavern had been used not only in the middle ages, but long previously. At the time of the Roman occupation, Baden was the encampment of a veteran legion who were well acquainted with the good qualities of the waters. Decided remains of the foundations of a vestibule were found at the entrance of the cave. In a niche hewn out of the rock was an altar with the sacrificial stone table. In front of the cavern was a regularly constructed building, fully ten feet below the surface of the ground above, designed probably to conceal the cavern behind, which was most probably employed as a temple to Mithras. There were two stalls for horses, fragments of utensils, knives, flint arrow-heads, carved bones, mixed up with Roman coins, lamps, and stamped tiles."

— M. Henniqué, the director of the colonial section which formed such a pronounced feature of the Paris Exposition of 1889, has followed up his suggestion for a colonial exhibition at Paris in 1892 with characteristic energy; and there is now every prospect of success, according to *Engineering* of April 17. The scheme, too, has immensely widened, and the society formed for its furtherance includes several members of the institute, many scientific men and political notabilities all working in earnest. The exhibition will be opened on May 1, 1892. It is to be held, of course, on the Champ de Mars; and the principal sections will be located in the Machinery Hall,— one of the glories of the 1889 exhibition, and at present used for popular gatherings on a large scale. Villages and encampments will be erected by natives of colonies, who will inhabit them, and in this way illustrate aboriginal life. The primary idea is to gather a thoroughly representative collection of the produce of the colonies of all nations, while the scientific and mechanical departments will indicate the methods adopted and possibility of adoption for development. It is not necessary to say that the popular attractions will be largely in evidence: Parisian management implies that. M. Lockroy, who had much to do with the 1889 exposition, being at the time minister of public instruction, is taking an active interest in the project. He has been elected president of the General Colonial Society, which is providing the necessary funds to the extent of $1,400,000. As soon as the Municipal Council grant the use of the Champ de Mars, the society will communicate with various nations, inviting co-operation. Special requests are to be made to Great Britain. Agents are at the same time to be sent to Africa, Asia, and America to arrange for groups of aboriginal tribes being sent to the exhibition. These will be changed from time to time, the exigencies of the ever-varying climate being the chief consideration in making the arrangements, so that denizens of the tropic as well as Arctic regions may be presented for the amusement of the patrons of the exhibition as well as for the study of ethnologists.

— At the meeting of the French Meteorological Society on March 3, a communication from M. Marès showed that the weather in Algeria had been as remarkable during the last winter as in Europe. The author stated, says *Nature*, that in many localities the excessive rainfall had prevented the sowing of seeds; and in the mountainous districts, where the sowing had taken place early, the seed had been swept away by the torrents. About the third week in January a heavy fall of snow lay on the Mitidja and the Sahel for two whole days. The writer states that for the last thirty-five years, although he had sometimes seen snow fall, it did not lie an instant on the ground. The effects had been disastrous to early crops and to many animals.

— A pleasant series of summer studies in botany was begun on April 28 by the Torrey Botanical Club and the College of Pharmacy of the City of New York, whose members have jointly arranged a course consisting of lectures and excursions extending throughout the summer. This course has been provided as a means of instruction for those business and professional men and women who desire to become practically acquainted with the chief principles of the science of botany and with local flora, but who are deprived of the ordinary means of study provided by schools and colleges. The course will consist of ten lectures by competent instructors, and ten excursions into the woods and fields by the lecturers and students. Professor Henry H. Rusby, Professor Henry Kraemer, and Professor Thomas Morong will be the lecturers.

— The executive committee of the last International Congress of Americanists, which was held in Paris from the 14th to the 20th of October last, decided that the next session of the congress should be held at such place as the Spanish Government should be pleased to indicate. The Spanish Government has now designated the Convent of Santa Maria de la Rabida, in the province of Huelva, as the place of the ninth session of the congress, which will commence on April 1, and end on Oct. 6, 1892. The Spanish Transatlantic Steamship Line offers free passage to two officially accredited delegates to the congress from each of the American republics, and half fare for all other duly accredited members who may desire to attend the congress at Santa Maria de la Rabida. The Spanish railways will likewise give delegates half fares. Any duly accredited person desiring to take part in the congress can apply for membership to the Spanish consulate here, and for a merely nominal fee will receive the proper credentials. The Convent of Santa Maria de la Rabida has been chosen by the Spanish Government because it is the place where Christopher Columbus received his first real encouragement in his plan to sail westward in an attempt to discover the Indies, and because it is near Palos, the port from which he sailed. The International Congress of Americanists has two aims,— to contribute to the progress of scientific studies, relative to the two Americas, especially in times previous to and immediately after Christopher Columbus, and to bring more closely together the persons engaged in such studies. A number of papers bearing upon matters in which the congress is interested will be read at the different sessions. Any paper requiring more than twenty minutes to read should be submitted in advance. The classes of questions on which papers are invited, and the various particular subjects under each class, are history, geography, archæology, anthropology, ethnography, language, and paleography.

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Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

TORNADOES: A STORY OF A LONG INHERITANCE.[1]

AFTER illustrating the effects of a number of tornadoes by lantern-slides, the lecturer defined a tornado as a violent whirling storm of small dimensions, rapid progression, and brief duration, and then considered the origin of its destructive winds. Following the generally accepted theory that the tornado whirl is developed in a convectional up-draught, it was shown, by analogy with the eddy of water running from a basin by a vent at the bottom, that if tornadoes did not whirl, they would lose most of their violence. But they all whirl, and nearly all in the same direction,— from right to left. The general possession of so well-marked a feature implies that it has been inherited from some antecedent condition, and it was therefore asked, where are tornadoes formed? The records of the Signal Service leave no room for doubt on this point: tornadoes are nearly always formed in the south-eastern quadrant of the large cyclonic storms or areas of low pressure, so characteristic of our daily weather-maps, and to whose passage across the country we owe most of our weather-changes. The cyclonic storms are vast whirls, their winds sweeping over great spirals as they gradually approach the centre of low pressure, but generally without destructive velocity, at least on land. The spirals of our cyclonic storms universally turn from right to left, and in this motion we undoubtedly have the reason for the general right-to-left whirling of the tornadoes; for, when a little whirl springs up in a great whirl, the turning of the two will be in the same direction. This may suffice to show why tornadoes turn; but it may next be asked why cyclonic storms turn. An answer will be found by examining the region of their occurrence. They are developed in the belt of prevailing westerly winds, which, taken as a whole, form a vast whirl from right to left around the north pole. When the cyclonic disturbance arises in this polar whirl, it must turn in the same direction as the polar whirl turns; that is, again from right to left. Tornadoes may therefore be said to have inherited their habit of turning from their grandparent, the general circulation of the winds of the northern hemisphere around the north pole.

But why do the winds whirl around in this way? Why not the other way? Why do they whirl at all? The sun warms the air at the equator, while it is cooled at the poles; the expanded equatorial air flows away aloft north and south, and for this reason we should expect to find caps of high pressure around the poles; but it must be remembered that the interchange between equator and poles was established in an atmosphere that was already rotating with the earth on which it lay. It possessed this rotation along with the oceans in the youth of the earth, when all was still glowing and molten with heat; and it was only later on, when the earth had cooled somewhat, that the sun began to determine our climatic zones, and start an atmospheric circulation: hence, as the equatorial overflow runs poleward, it approaches the axis about which it rotates. In accordance with the principle of the conservation of areas, it must take on a whirl around the pole from west to east, or, as the North Star would say, from right to left; and this whirl is so much faster than the rotation of the earth that the high pressure expected at the poles as a result of low temperature is reversed into low pressure, due to excessive centrifugal force. We thus learn that the prevailing winds whirl around the pole because they had a way of turning with the earth; that the cyclonic storms possess a spiral circulation from right to left because they are formed in a whirling atmosphere; and that the tornadoes whirl because they are generated in whirling cyclones.

But why does the earth rotate? On inspecting the planets of our system, we find that rotation appears to be a common characteristic of all. The sun, the moon, Mars, Jupiter, and Saturn all turn one way, these being the only bodies of our system whose direction of rotation has been surely observed. Moreover, they all turn on their axes in the same way as they revolve around the sun in their orbits. Saturn's rings turn in the same direction. Let us imagine what would happen if these rings were clotted somewhat at a certain point: the parts behind the clot would be hurried on, and thus gaining a greater orbital velocity, and consequently a greater centrifugal force, would tend to pass outside of the clot; the parts ahead of the clot would be retarded, and, thus losing some of the centrifugal force that they had before, would be drawn by the planet somewhat inside of the clot; the parts outside of the clot would be drawn inwards, and, thus approaching the centre of their orbital revolution, they would be accelerated, and would tend to run ahead of the clot; while the parts on the inside of the ring would be drawn outwards, and would lag behind the clot. All these parts thus conspire to set up a whirling around the clot as a centre, still maintaining their orbital motion around Saturn. As a result, when all the matter of the rings is concentrated at the clot, it will form a mass possessed of an axial rotation; and this rotation will be in the same direction as its orbital revolution. It has therefore been supposed that the planets once existed as rings around the sun; that the rings were not so evenly balanced as are those of Saturn, which survive as rings even to this day; and that the planetary rings gradually coalesced into rotating balls, and thus gained their community of rotation. And yet why should the planetary rings have all rotated the same way? For no reason, unless they inherited their movement from a common ancestor. This ancestor is thought to have been a vast nebula, whose inward spiral falling together gradually produced the rings, all turning one way around the great central mass, which later formed the sun. But why did the nebula turn around? Why did its parts not simply fall together in radial lines? Because the nebula came from chaos, and we must not imagine that chaos possessed so specialized an arrangement as no motion, or as precisely such motions as would neutralize all tendency to rotation while its parts were falling towards their common centre of gravity. Any thing but this in chaos. There must have been motions of all kinds, and, their resultant being unbalanced with respect to their centre, they necessarily developed a whirl as they coalesced into the primeval nebula; and this whirl, through rings, planets, winds, cyclones, and tornadoes, has never been lost.

It is not simply to the imagination that we must trust for our realization of these past stages of our history. The sun, being vastly larger than the earth, still retains a glowing temperature, such as the earth has long since lost. Saturn's rings, evenly balanced, marvellous examples of retarded development, illustrate a stage long out of date with the unevenly arranged rings of the planets. Most of the nebulæ of the distant sky are still in the chaotic stage; but the great nebula of Andromeda, when finely photographed, shows a series of incurving spirals, such as the North Star saw in our nebula so long ago. It is the inheritance of this early habit that makes our tornadoes whirl.

[1] Abstract of a lecture before the Johns Hopkins University Travellers' Club, Jan. 27, 1891, by Professor William Morris Davis of Harvard University.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Flying-Machines.

FROM the age of mythology to the present time man has attempted to unravel the mysteries of flight, and to imitate the bird in its easy conquest of the ocean above us. The study of this question has been left to cranks or semi-intelligent dabblers in science. One of the latest instances was that of Mr. Lancaster, who was treated rather coolly at Buffalo at the meeting of the American Association in 1886. An offer of a hundred dollars was made for the display of a model that would meet his claims, but it is needless to add that the money did not change hands. Only last week, however, the usual rule was broken, as Professor Langley, who has a world-wide reputation as an eminent scientist, entered the lists as a champion of the idea that a flying-machine is practicable. We have been somewhat disappointed, however, on looking carefully into his scheme, and very much fear that he has only succeeded in more perfectly proving the impracticability of a direct imitation of the bird.

Professor Langley illustrates his views by drawing a picture of a man walking upon a series of cakes of ice, each one of which is so small that he would sink if he does not pass very quickly from one to the next. It is plain that if the man is given no assistance except a violent up-and-down movement of the arms, in imitation of a bird's wings, he would go down if he stood still; but suppose he had a pole resting on the bottom, it is easy to see that by exerting a slight pressure upon the pole he would be sustained by the cake of ice. We may well believe that the exertion required to support a part of one's weight in this manner would be very much less than that required to pass quickly from cake to cake. The same reasoning may be applied to a heavy bird standing upon ice: it may run from cake to cake with wings closed, or it may stand still and gently support a part of its weight by a use of its wings. In the latter case the exertion required would be much less than in the former. This idea of adaptability would seem to lie at the bottom of this whole subject.

If we had a balloon weighing two hundred pounds, and inflated, it would rise till it reached an equilibrium at two thousand feet, say. The exertion required to move it a limited distance in any direction, down or up, or sidewise, would be exactly the same. If, now, we empty the gas, we have changed all the conditions of flotation; and the covering, if compacted, at once falls with great speed to the earth. To keep up this ball of cloth by a blast of air would require the expenditure of a great deal of energy; and in like manner, if we undertook to transport it horizontally by a blast of air, and keep it from falling, it would require still more force: in fact, it is evident that a horizontal blast could not keep the body from falling, no matter what its force. On the other hand, we may support the ball by a cord, and then we can move it in any direction a short distance horizontally with the very slightest exertion.

Suppose the cloth of the balloon, instead of being compacted, could be stretched in a plane surface. The velocity of its fall would be much diminished; but to keep up a blast of air from outside to support this plane, or to move it horizontally, would require the expenditure of much more energy than before. Let us change the condition and apply the force directly to the plane, inclining it at the same time with the horizontal. It is evident that with an angle of 45° the resistance from the air would be large as compared with the skin-friction; but if the angle is made very small, say one degree, the total resistance at a much higher velocity would be the same as before. It would seem, however, that a plane under these conditions could be balanced only with the greatest difficulty; and, as Professor Langley has said, the steering and propelling apparatus have yet to be devised. It is easy to see that, after all, these three points are really the essentials; and if it can be shown that a plane, which is so very different from the bird in its form and adaptation to the air, is really essential to a solution of the problem, then we may say that it has been conclusively proved that a flying-machine pure and simple cannot be constructed. We may hope to vie with the bird, but we can never go beyond it in its general form, adaptability, and mode of action in flight.

Professor Langley thinks we can go fast much more easily than we can go slow. It is evident, however, that a bird does not support itself by going fast, for we have examples of its soaring and remaining stationary for quite a long time. It would seem, also, that the practical solution of the problem would be rendered much more difficult at great velocities. As a matter of fact, it would be much easier to go slow than fast; for the propeller, ballast, and other parts would have to be increased in such a ratio as the velocity increased, that the resistance of the air would become enormous, amounting, as it does, to forty pounds per square foot at a hundred miles per hour.

Professor Le Conte of San Francisco, in a recent number of the *Popular Science Monthly*, has summarized the arguments against flying-machines, and his position certainly seems impregnable. These arguments may be briefly paraphrased.

1. We can never construct a mode of utilizing fuel or a source of energy which shall equal the bird.

2. We can never build a machine which shall have such perfect adaptation to flight in all its parts as the bird has.

3. There is a limit of weight, probably fifty pounds, beyond which a bird cannot fly. Obviously a self-raising, self-supporting, and self-propelling flying-machine to carry a man is impossible.

H. A. HAZEN.

Washington, D.C., April 25.

Protection from Lightning.

I RECEIVED an invitation from you some time ago to criticise your theory of lightning, and since then I have been rolling the idea about in my mind to look at the lightning longitudinally, transversely, and askance. It was so novel that I did not quite get the idea at first reading, and it was so different from my already partly well defined views that I had to think about it, which accounts for my delay in replying. Some of your arguments are very strong; say, the observations of the stroke upon the steeple, etc., supposing that to be well authenticated. I don't believe I am well prepared to deny but you may have the solution, and I should be glad to know that you had.

Now, does not your theory imply that the first step in the transferrence of electric energy from an electrified cloud is to produce a stress in the ether between the cloud and another adjacent body, say the nearest, either cloud or earth; that the energy is therefore in the ether until the discharge takes place, and the discharge is the unloading the ether in a direction at right angles with the direction of the stress? The electricity, therefore, is not transferred from cloud to earth or from earth to cloud, but is only a kind of static collapse. Perhaps this does not quite represent your idea.

A. E. DOLBEAR.

College Hill, Mass., April 19.

BOOK-REVIEWS.

Outlines of Physiological Psychology. By GEORGE TRUMBULL LADD. NEW YORK, Scribner.

PROFESSOR LADD'S larger work, "The Elements of Physiological Psychology," is so well known to all students of this topic that this abridgment of the larger work hardly calls for extended notice. The scope of the work and the manner of treatment are essentially similar to those of the "Elements," and its handier form will undoubtedly make it a welcome volume to a large circle of students. It is distinctly the only work in English that pays due attention to the experimental work of foreign psychologists; and American readers, no matter what their points of agreement or disagreement with Professor Ladd's views may be, should be distinctly grateful for this useful service. One cannot repress the wish, however, that, while so much pains and ability were being exercised in compiling the volume, a little better perspective of view, a little more lucid and attractive form of statement, had

been added. These two defects will seriously hinder the service of the "Outlines," as they have of the "Elements." The facts which the beginner in psychology and the general reader alike need and desire, are the chief facts of modern scientific psychology in all its various departments. What is here termed "physiological psychology" is but a somewhat arbitrarily selected portion of that general body of knowledge. And within the field covered we find the same disproportion among the topics. The preliminary portion on the nervous system and the functions of the brain certainly occupies too much space for so elementary a work.

There is, too, a lack of vitality in certain portions of the work,— something that gives the student the impression that he is dealing with reports of papers and personal news, and not with facts and their interpretation. This defect is less marked in the newer work. It, too, has the advantage of benefiting by the more recent studies and the criticisms directed against the "Elements." While regretting these defects, we may none the less cordially recommend these volumes as an important and interesting means of approach to an important and interesting subject.

Animal Life and Intelligence. By C. LLOYD MORGAN, F.G.S. Boston, Ginn.

ONE of the dominant characteristics of modern English science is the attention devoted to the study of mental phenomena from a general biological point of view; the application of the comparative method, under the guidance of the principle of evolution, to the various activities contributing to and conditioning life, both bodily and mental. In so far as there exists a school of scientific psychologists in England, this is the common principle of their unity. A majority of the best known of modern English psychologists are men with a thorough and generally a professional biological training, who view the study of mind as a factor, and a most important and intricate one, in the general series of actions and re-actions of which life consists. It need hardly be said that in so doing they are continuing along the path so splendidly opened out by Darwin. It is to this school of thinkers that Mr. Morgan belongs; it is to this phase of psychology, or, if you prefer, biology, that the present work is devoted. The cardinal position of the work maintains the necessity of studying mind as a part of life, of studying it comparatively, of explaining, classifying, and studying mental phenomena by their purpose and significance in the natural, the biological world.

As the title implies, the work is divided into two portions,— the one setting forth the phenomena of animal life, the other dealing more particularly with those functions of life in which intelligence is involved; and it is extremely convenient to have so able a treatment of both topics between the same covers. For the student or the general reader whose aim it is to secure by the reading of a single book some insight into those central problems of biology, life, and intelligence, Mr. Morgan's is the book to be recommended. It is not an exhaustive treatment, but the selection of topics is according to the centres of most vital interest; and the treatment is always judicious, many-sided, interesting, and clear. After a general description of the qualities by which the organic is differentiated from the inorganic, and of the more important of the processes by which an individual life is maintained, runs the cycle of its life-history, and leaves its offspring to perpetuate the species, we are introduced to the kernel of modern biology, the relation of life to the environment. This portion of the work is considered under the heads of "Variation and Natural Selection," "Heredity and the Origin of Variations," and "Organic Evolution." While much of the contents of these chapters is mainly expository, and thus admits of originality or peculiarity mainly in the mode of treatment, the disputed points in modern biology are by no means avoided, and both sides of the case are always given. Chief among these disputed points is the one over which the biological camps are so sharply divided,— the inheritance of acquired characteristics. Mr. Morgan admirably states the importance of this issue, and returns to the problem again and again. He instructively as well as amusingly discusses the issue by considering whether "the hen produces the egg" or "the egg produces the hen." The Weismann view, which denies the inheritance of the influences of individual environment, would hold that "the egg produces the hen," and the parent egg is connected with the young egg, each developing to maturity under its own conditions; while, under the opposite view, "the hen produces the egg," that is, the egg is the offspring of the mature hen, modified since birth by a host of environmental accidents and conditions. Mr. Morgan's final position, reached by dint of much balancing and consideration, may be gathered from the following words: "Now, although I value highly Professor Weismann's luminous researches, and read with interest his ingenious speculations, I cannot but regard his doctrine of the continuity of germ-plasm as a distinctly retrograde step." So, too, in the mental world Mr. Morgan regards the hypothesis of the non-inheritance of acquired characteristics as untenable, though he fully admits the absence of crucial cases, and the possibility of interpretation of many facts from both points of view. In his final chapter he deduces from Professor Weismann's views the conclusion that education, "though it may raise the level of each generation, can have no cumulative effect;" that the diffusion of knowledge brings more grist to the mill but doesn't improve the mill, increases the store of food but not the powers of the digestive apparatus; and, in opposition to this view, it is held that the rise in the intellectual level of Englishmen of to-day, as compared with those of the days of the Tudors, has been in part due to the inheritance of individually acquired faculty."

Mr. Morgan's views on other of the factors and processes of organic evolution possess many points of interest and individuality, but it is impossible to do more than mention their existence in this connection. Some of the points which he emphasizes may be inferred from the following citation: "First, we should be careful not to use the phrase 'of advantage to the species' vaguely and indefinitely, but should in all cases endeavor clearly to indicate wherein lies the particular advantage, and how its possession enables the organism to escape elimination; next, we must remember that the advantage must be immediate and present, prospective advantage being, of course, inoperative; then we must endeavor to show that the advantage is really sufficient to decide the question of elimination or non-elimination; lastly, we must distinguish between indiscriminate and differential destruction, between mere numerical reduction by death or otherwise and selective elimination."

Entering now upon the more strictly psychological portion of the work, we meet first with a very clear and interesting account of the realm of sensation in the animal world. The keynote of the exposition is that the activity of a sense-organ must be accounted for by the utility of this mode of response to the environment in the struggle for existence. The fallacy of insisting upon an exact parallelism between human senses and those of animals is also strongly stated. The ground covered in the chapter upon "Mental Processes in Man" is familiar. It consists in the main of the description of the various processes involved in sensation, perception, inference, and the like. The two points most strongly insisted upon are that the relation to our environment involves the two factors of subject and object, of the mind that perceives and the things perceived; and that we must distinguish between the perceptual and the conceptual powers, the latter involving analysis and to some extent abstraction and consciousness. In attempting to study the resemblances and differences between human and animal intelligence, we must beware of endowing the animal with human points of view. The similarity of sense data is no guaranty for a similarity of mental perception and elaboration. In illustration of our tendency to neglect the ignorance of animals, there is cited Mr. Hamerton's story of the cow which was quieted by having the stuffed body of her dead calf to lick, and which, when accidentally tearing open the skin and seeing the hay inside, devoured the unexpected provender without showing the slightest surprise. But the surprise is only for us acquainted with anatomy: it is no incongruity to the cow, which indeed, having experience of "putting hay inside," not illogically expects to find hay there. We each construct our world, and how different the constructive powers in the two cases! In the description of instances of animal intelligence, which naturally find considerable place in the work, the analysis proceeds along a psychological basis, the degree of mental power being measured by

the degree of elaboration of the sense data. The same act may be accomplished by practical insight and by reasoned inference, but the grade of the processes be markedly different. The monkey that unscrews the hearth-brush from its handle doesn't discover the principle of the screw, but simply observes that certain actions lead to certain ends. This higher conceptual form of reason Mr. Morgan denies to animals; but, while "contending that intelligence is not reason, I [do not] wish in any way to disparage intelligence. Nine-tenths, at least, of the actions of average men are intelligent and not rational. Do we not all of us know hundreds of practical men who are in the highest degree intelligent, but in whom the rational analytic faculty is but little developed? Is it any injustice to the brutes to contend that their inferences are of the same order as those of these excellent practical folk?"

But intelligence is not the only factor in life, and indeed is always dependent upon some sensible, some emotional state; while its existence is evidenced only by some expression, some exercise of a motor activity. The origin and function of pleasure and pain, the relation between the emotions and their expression, the difficulty of appreciating how far and in what way animals are sensitive to pain (and many striking examples of apparent insensibility are given), the relative dignity and distribution of various typical emotions, to what extent the more intellectual and moral emotions may be present, — these are the points most fully considered. So, too, on the motor side are considered the various forms and grades of response to stimuli by which intelligence is manifested. What on the intellectual side is formulated as the distinction between intelligence and reason, on the motor side becomes instinct and rational habit. The far greater share which frequently repeated acts occupy in the lower animals, the earlier age at which in the lower animals these instincts emerge, the persistency with which they seek expression even under ridiculously inappropriate conditions, are some of the traits of importance in this regard. If there is one problem in comparative psychology upon which there are as many minds as there are men, it is that of instinct; and Mr. Morgan very naturally devotes some space in bringing out his own views and criticising those of others, more particularly in showing his agreement and points of dissension from Mr. Romanes. The final chapter of the volume deals with mental evolution as a whole, and with a philosophical expression of the relation of the subject to the object, of the act of intelligence to the objective source of sentience. Under the former head we have a clear and commonsense statement of the value and difficulties of appreciating the various and graded forms of mind, the continuous hierarchy of psychological stages. Under the latter Mr. Morgan states his monistic philosophy, his belief that there is one something showing two aspects, the physical and the psychological. The one deals with the physical forms of energy (kinesis); the forms exhibited by the other may then be called "metakinesis;" and, "according to the monistic hypothesis, kinesis and metakinesis are co-ordinate. The physiologist may explain all the activities of men and animals in terms of kinesis. The psychologist may explain all the thoughts and emotions of man in terms of metakinesis. They are studying the different phenomenal aspects of the same noumenal sequences."

When leaving the book, we do so with the conviction that it will take an important place in the literature of biology and psychology, by reason of the timeliness and good perspective of its chapters, by the clearness and many-sidedness of its expositions, by the suggestiveness and stimulus of its main position. Though containing much that is sure to require modification in the near future, and also considerable that is personal opinion rather than demonstrated truth, the volume may be cordially recommended as a most satisfactory way of approach to modern biological psychology.

IN the *New England Magazine* for May, 1891, appear, among other matter, "The Notes of Some New England Birds," by Simeon Pease Cheney; "The Alaskan Fur Trade," by Charles Hallock; and "The Oldest House in Washington" (illustrated), by Milton T. Adkins.

AMONG THE PUBLISHERS.

THE eleventh part of Edwards's "Butterflies of North America," just issued, is in every way equal to its predecessors. For the first time in this third series, each of the three large quarto plates, with the accompanying text, is given up to a single and relatively little known species of butterfly; two of them to species of *Satyrinæ*, a group which nowhere in the world has found so complete a treatment as in America, at the hands of our author. Excepting for the intermediate larval stages of *Satyrus meadii*, every single stage of the creature's life is represented, usually by more than a single figure, and all in that exquisite and finely exact style we have become accustomed to in this work, but which can never be too highly praised or too fully appreciated. Such illustrations lie at the very foundation of the exact knowledge of butterflies, and are the key to any proper understanding of their real relationships. The butterflies treated of are *Apatura flora*, *Satyrus meadii*, and *Chionobas chryxus*, all of them living from five hundred to a thousand or two miles from Mr. Edwards's home, where they were bred and studied. This shows at once the opportunities to be overtaken by any zealous student, and renders possible thorough acquaintance with our entire fauna. Mr. Edwards hints here and there at some of the difficulties of the work, to have overcome which, even partially, in the case of such distant and secluded insects as this *Satyrus* and this *Chionobas*, is a high merit indeed. *Apatura flora* is an inhabitant of our extreme southern border; *Satyrus meadii* lives at moderate altitudes in restricted localities in Colorado, New Mexico, Arizona, and Montana; and *Chionobas Chryxus* at higher elevations in the Rocky Mountains from Colorado to British America, and, if with Mr. Edwards we include *calais* in the species, also across the continent in the higher north. In all three species the caterpillars hibernate in early life; but the history of the species as given here presents nothing of unusual interest, and closely resembles that of their nearest allies. Eighty-one figures, most of them colored and many much magnified, are given on the three plates.

— Julius Bien & Co., New York City, announce that they will publish an "Atlas of the State of New York," provided sufficient encouragement is secured to warrant so costly an undertaking. Among the proposed features of the work are these: a general map of the State, exhibiting county and town boundaries, etc., railroads, canals, and all important cities and towns; temperature and rainfall maps; detailed maps of the counties, sixty in number, showing public roads, rivers, lakes, city and township boundaries, etc.; railroad lines and stations; street maps, on a large scale, of the principal cities; lines of original land patents; an alphabetical list of counties, townships, cities, and villages, with population from last census, and an enumeration of all post-offices.

— Professor F. M. Taylor of Michigan University will shortly publish in the "Proceedings of the American Academy of Political and Social Science" an article on "Natural Law," which deserves the attention of every one interested in political questions. The author joins issue with the current notions on that subject, and attempts to show how true the popular instinct is which prompts a man to defend his elementary rights, if need be, by force.

— There is announced to appear soon the first number of the *Pantobiblion*, a monthly international bibliographical review of the world's scientific literature. In the words of the prospectus, "The purpose of this new monthly is to help the literary men of any department concerned with the applied sciences generally, and particularly those devoted to any technical studies of any specialty, to be promptly, exactly, and completely informed of the correspondent branch of current scientific literature, and to keep pace with the times as regards the advancement of applied sciences, and especially of technics and engineering of every sort." The editor of the *Pantobiblion* is A. Kersha, civil engineer, Fontanka 64, St. Petersburg, Russia. American subscription orders may be addressed to Messrs. D. Appleton & Co, New York.

— The Johns Hopkins Press, Baltimore, announces for early publication "American Oyster-Culture with Special Reference to the Past and Future of the Oyster Interest of Maryland," a popular

summary of a scientific study, by William K. Brooks, Ph.D., professor of animal morphology in the Johns Hopkins University of Baltimore, and director of the Chesapeake Zoölogical Laboratory. The danger to our oyster interest, this great natural source of prosperity, is now generally admitted, and the methods of restoring and developing depleted beds which were advocated by Professor Brooks attract more and more attention. The author has been urged to prepare a new work on this subject, as his reports on the "Embryology of the Oyster" and on "The Oyster Industry of Maryland," which were published by the Johns Hopkins University in 1879 and 1884, are now out of print. In accordance with these requests, a complete revision of the former reports, with the addition of new matter, has been prepared. Dr. Brooks served as one of the Oyster Commission of the State of Maryland in the years 1883–84, and received from the Société d'Acclimatation of Paris, in 1880, its medal for his researches on the development of the oyster.

—Charles W. Dulles, M.D., retires this week from the editorship of the Philadelphia *Medical and Surgical Reporter*.

—From Thomas Whittaker, publisher, we have received "The Life Story of Our Earth" and "The Story of Early Man," by N. D'Anvers. These small volumes, of about one hundred and fifty pages each, belong to the Science Ladders Series,—a series of handy volumes intended to give young people some knowledge of the laws of nature and the progress of science. The books are written in language simple and easily understood, yet sufficiently accurate for the purpose in view; and the illustrations, though not as good as might be expected in books of the kind, are well chosen and plentiful.

—The March number of the new Zealand *Journal of Science*, which is the second number of the new issue, contains "The Forthcoming 'Flora' of New Zealand;" "Some Notes on the Occurrence of the Trap-door Spider at Lyttelton," by Robert M. Laing; "An Edible Fungus of New Zealand;" "New Caledonia Nickel Ores," by Thomas Moore; "On the Discovery of the Nickel-Iron Alloy Awaruite," by G. H. F. Ulrich; "On the History of the Kiwi," by T. J. Parker; "Botanical Notes," by D. Petrie; "Effects of Thunder on Milk;" "Escallonia macrantha and Bees;" "Fertilization of Native Flowers by Honey-bees;" "On the Preservation of Solution of Sulphuretted Hydrogen;" "The Anatomy of a New Zealand Earth-worm;" "Recent Papers on the Natural History of New Zealand;" "Occurrence of Glow-worms in a Deep Cave;" "Humble-bees;" "Australasian Association for the Advancement of Science;" "On the Preservation of the Native Fauna and Flora of New Zealand;" "The Bull-roarer of some Australian Tribes;" and "Linnean Society of New South Wales." The magazine is published by Matthews, Baxter, & Co., Dunedin, N. Z.

—Among the new books of Messrs. Kegan Paul, Trench, Trübner, & Co. are "The History of Canada," by William Kingsford, LL.D.; "Essays in Politics," wherein some of the political questions of the day are reviewed from a constitutional and historical standpoint, by C. B. Roylance Kent (the word "politics" is used by the author in the wide sense as including all those questions which affect the life of men as members of society; and he discusses some of the more important questions of modern politics from a constitutional and historical standpoint, and gives them their due place in the larger sphere or area of the political science to which they belong, grouping them under such general headings as "Questions of Sovereignty," "Federal Government," "Political Institutions of Switzerland," "Progress of the 'Masses,'" "Socialistic Legislation," "Science and Politics"); "Alone through Syria," by Ellen E. Miller; "Sketches from a Nile Steamer," by Mrs. Tirard; "Buried Cities and Bible Countries," by George St. Clair; "Pessimism: A History and a Criticism," by James Sully (second edition, with new preface); "Principles of Natural and Supernatural Morals," Vol. II. "Supernatural Morals," by the Rev. Henry Hughes; "Body, Parentage, and Character in History," notes on the Tudor period, by Furneaux Jordan; and "Simplified Grammar of the Telugu Language," by Henry Morris, with a map of India showing the Telugu country.

—In the May issue of the *Magazine of American History* we note, "A Great Public Character," in which the career of William H. Seward is traced. The second paper is "An Early West Pointer," by Hon. Charles Aldrich of Iowa. Then comes a treatise entitled "A Lost Chapter in American History," by Rev. Dr. George Patterson of Glasgow, in which the early attempts of the Portuguese to colonize the north-eastern coast of America are pointed out. "The First American Ship," a brief article by Professor G. Brown Goode of the Smithsonian Institute; "Some California Documents," from Charles Howard Shinn of San Francisco; and "General Varnum on a Constitution of Government, in 1787," from Gen. James M. Varnum of New York,—are valuable contributions.

—In the *Forum* for May are three scientific articles likely to interest our readers, in addition to many others, of course, which cannot be classed strictly as scientific. One of the three is on "The Transmission of Culture," by Professor Lester F. Ward; the second is on "Chemistry To-day, and its Problems," by Professor William Crookes; and the third is on "The Bertillon System of Identification," by Alphonse Bertillon. Professor Crookes does not approve of speaking of a new and an old chemistry, yet points out important advances.

—The May number of the *Educational Review* will have an interest to many because of its containing probably the last public expression of the late Dr. Howard Crosby,—a brief article on "Religion in the Common Schools;" and also an article on "My Pedagogic Autobiography," left unfinished by the late R. H. Quick, the author of "Educational Reformers." The other features of the number are articles on "The Limitations of State Universities," by Ex-President Horace Davis of the University of California, and on "The Teaching of History in the Elementary Schools," by Professor Salmon of Vassar; the last of Professor De Garmo's papers on Herbart; a letter from Friedrich Kirchner on educational matters in Prussia; the Bishop of Durham's recent address before the University Extension Society, on "Ideals;" and reviews by Professors Tracy Peck of Yale, A. B. Hart of Harvard, John Dewey of the University of Michigan, William North Rice of Wesleyan, Dr. J. H. Hyslop of Columbia, and Hon. D. H. Chamberlain.

—At the meeting of the Royal Geological Society, Feb. 20, the Bigsby medal was awarded to Dr. G. M. Dawson, F.G.S., of Ottawa. On handing the medal to Dr. Hicks, F.R.S., for transmission to the recipient, the president addressed him as follows: "In asking you to transmit the Bigsby medal to Dr. George M. Dawson, I request you to convey to him at the same time an assurance of how fully the council appreciates the value of his researches into the geological structure of Canada, and how cordially we hope that he may live long to prosecute the explorations which have shed so much lustre on the Geological Survey of his native country."

—The following is a complete list of the papers read at the April meeting of the National Academy of Sciences: "Further Studies on the Brain of Limulus Polyphemus," by A. S. Packard; "On Aerodromics," by S. P. Langley; "The Solar Corona, an Instance of the Newtonian Potential in the Case of Repulsion," by F. H. Bigelow; "Report on the Human Bones of the Hemenway Collection in the United States Army Medical Museum, prepared by Dr. Washington Matthews, U.S.A.," by J. S. Billings; "Application of Interference Methods to Spectroscopic Measurements," by A. A. Michelson; "The Corona from Photographs of the Eclipse of Jan. 1, 1889," by H. S. Pritchett; "Stellar Motion Problems," by Lewis Boss; "Effect of Pressure and Temperature on the Decomposition of Diazo-Compounds," and "Researches on the Double Halides," by Ira Remsen; "Allotropic Silver," and "Note on a Paper by M. G. Lippmann," by M. Carey Lea; "On the Yttrium Earths, and a Method of making Pure Yttrium," by H. A. Rowland; report of the Watson trustees, and presentation of the Watson Medal to Professor Arthur Auwers of Berlin; "On the Distribution of Colors in Certain North American Reptiles," by E. D. Cope; "The Taxonomy of the Apodal Fishes," by Theo. Gill; "Researches on the Embryology of Mollusks," by W. K. Brooks and E. G. Conklin.

INDUSTRIAL NOTES.

Electrical Instruments for Schools.

THE immense spread of electrical invention and application has required the services of many workers. It no longer suffices that these workers be taken from other callings, or thrust out untrained from our grammar-schools and academies. They must

FIG. 1.

FIG. 2.

be skilled not only in the theory, but in the actual use of instruments and machines. But all cannot go to colleges and engineering schools to acquire this knowledge, and, even if they could, the colleges have not time to go back to elementary principles and teach the elementary use of instruments: hence a great part of this work must be left to the high-schools and other preparatory institutions throughout the country. Recognizing this fact, *a priori*, as well as in consequence of many and repeated demands from the schools themselves, Messrs. Queen & Co. have just designed and placed upon the market a complete series of electrical testing instruments for school use. Queen & Co.'s list of this

FIG. 3.

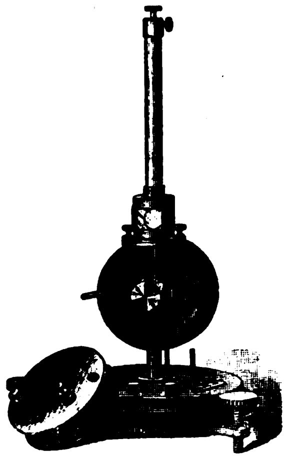

FIG. 4.

apparatus embraces all the instruments needed for a full year's course in laboratory electricity, and includes galvanometers of all kinds, resistance-boxes, Wheatstone bridges, voltmeters, etc. We note, from inspection of their catalogue, seven styles of winding of simple horizontal galvanometers; thus, the first one will measure currents from .01 to .5 of an ampère, and detect currents as small as .0025 of an ampère. This galvanometer is illustrated in Fig. 1. Fig. 2 shows a galvanometer which has, in addition to the usual winding of wire, a heavy copper strip allowing the measurement of currents up to 40 and 50 ampères. In addition to these simple galvanometers, are several styles of fibre-suspended galvanometers having an astatic system of needles and pointer moving over a finely graduated circle, so that deflections can be easily read. For still better work, the galvanometer shown in Fig. 3 has been specially designed. This galvanometer is built somewhat upon the plan of the well-known tripod galvanometer of Sir William Thomson, and is extremely sensitive. The mirror, which is very light, carries the magnetic system (several small bits of steel) on its back, and the whole is suspended by a very fine cocoon fibre about seven inches long. The coils are two in number, and may be connected in series or in parallel, as desired. They are easily movable. The magnetic system is enclosed by a thin, plane glass in front, and by another similar one behind. The latter is fixed in the end of a small tube which slips easily in the central axis of the rear coil, so that the air-space may thereby be easily increased or decreased at will. The galvanometer may in this way be made dead-beat or used undamped, as desired. By pushing the sliding tube until the air-space becomes small, readings may be taken with great rapidity, as the mirror will come to rest very quickly. The galvanometer may be made even more sensitive by the use of a control-magnet arranged to slide upon the tube containing the suspending fibre. This type of galvanometer is supplied wound to resistances of 100, 800, or 2,000 ohms, according to order.

Fig. 4 is an illustration of a galvanometer which will also be found useful. The coils, as in the last type mentioned, are two in

FIG. 5.

number, and may be coupled up in series or multiple, as desired. They are easily removable, and enclose a heavy block of copper fixed in a central fork. This copper block has a small cylinder bored partly through, in which hangs the bell-magnet making up the moving system. The magnet, with mirror attached, is suspended by a long and fine cocoon fibre, and, in consequence of being enclosed in the copper block, comes to rest very quickly after being deflected. In measuring and comparing condenser capacities, electro-motive forces, battery resistances, etc., by condenser methods, this galvanometer is very good, for, by simply lifting the copper block off the fork which supports it, the instrument is made ballistic. The coils are held in place by a special

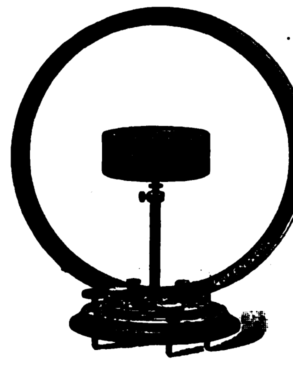

FIG. 6.

device, so that they may be readily changed for coils of other resistances, thus adapting the instrument to almost all varieties of galvanometer work. This galvanometer, like the preceding, is furnished with any of several windings, or with several sets of coils for the same instrument, thus making it applicable to measurements of various kinds.

Another valuable type of reflecting galvanometer is the Deprez-D'Arsonval dead-beat galvanometer (Fig. 5), or, as it is commonly called, the D'Arsonval galvanometer.

This type of instrument has won favor with all, on account of its great delicacy of action, simplicity, and convenience. In a recent article in the *London Electrician*, Professor W. E. Ayrton gives it as his opinion, that, properly constructed, this type of galvanometer, is the most sensitive instrument known for the detection or measurement of electrical quantities. It is one of the finest of the "dead-beat" variety; and the needle, after being deflected, returns to its zero position immediately, and without the slightest oscillation, while it is so sensitive that it may easily be deflected through a considerable arc by simply touching the fingers to the two terminals of the instrument. The induction-currents produced by turning a coil of wire about a diameter so as to cut the earth's lines of force may also be rendered visible to an entire

FIG. 7.

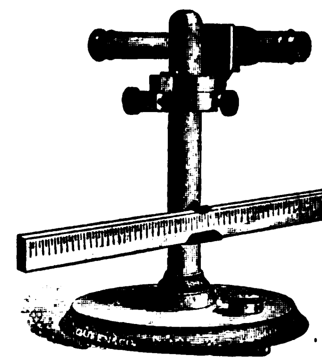

FIG. 8.

Publications received at Editor's Office, April 20–25.

BREWER, E. C. The Historic Note-Book: with an Appendix of Battles. Philadelphia, Lippincott. 997 p. 8°.
CONNECTICUT, Thirteenth Annual Report of the State Board of Health of the State of, for the Year ending Nov. 30, 1890. New Haven, State. 196 p. 8°.
EMERY, F. P. Notes on English Literature. Boston, Ginn. 155 p. 12°. $1.10.
FEWKES, J. W., *ed.* A Journal of American Ethnology and Archæology. Vol. I. Boston and New York, Houghton, Mifflin, & Co. 132 p. 8°. $2.
HARPER, W. R., and TOLMAN, H. C. Eight Books of Cæsar's Gallic War. New York, Cincinnati, and Chicago, American Book Co. 502 p. 12°. $1.20.
KANSAS Academy of Science, Transactions of the Twenty-second Meeting of the, 1889. Vol. XII. Part. I. Topeka, Kan. Pub. House. 189 p. 8°.
MASSACHUSETTS State Agricultural Experiment Station at Amherst, Eighth Annual Report of the Board of Control of the, 1890. Boston, State. 324 p. 8°.
NEW ZEALAND Journal of Science, The. Vol. I. No. 1. January, 1891. Dunedin, Matthews, Baxter, & Co. 48 p. 8°.
PACKARD, A. S. Insects Injurious to Forest and Shade Trees. (U. S. Entom.) Commis., Bull. No. 7. Washington, Government. 957 p. 8°.
POWERS, E. War and the Weather. Revised ed. Delavan, Wis., The Author. 202 p. 12°. $1.
RIBOT, Th. The Diseases of Personality. Chicago, Open Court Pub. Co. 157 p. 12°. 75 cents.
ROYAL SOCIETY of Canada Hand-Book. Montreal Meeting, 1891. Montreal, Roy. Soc. Can. 140 p. 16°.
WRIGHT, L. Optical Projection: A Treatise on the Use of the Lantern, etc. London and New York, Longmans, Green, & Co. 426 p. 12°. $2.25.
ZOOLOGICAL Gardens and Aquaria for Boston: An Appeal. Boston, Bost. Soc. Nat. Hist. 47 p. 24°.

class. Another great advantage in instruments of this type is the fact that they are not affected by proximity to masses of iron or dynamo-machines.

Several styles of tangen galvanometers are also included in this list. Fig. 6 illustrates them. This instrument, properly adjusted, can be used as a standard instrument for laboratory work with entire satisfaction. The brass ring is thirteen inches and a half in diameter, and the groove in which the wire is wound is carefully turned so as to be of perfectly rectangular cross-section, thus allowing the constant of the instrument to be carefully calculated, and compared with the constant as obtained by other methods. The whole instrument has been specially designed to meet the requirements of teachers in laboratory practice who desire to make students entirely familiar with all the adjustments of the standard galvanometer before putting a high-grade instrument in their hands. The compass-box, five inches in diameter, is so held in position that it may be raised or lowered, rotated on its vertical axis, shifted out of the plane of the coil, etc., thus enabling the student to acquire proficiency with the instrument, and to meet all cases of derangement possible.

The dial is graduated to single degrees, while a mirror under it allows readings to be made without error of parallax. The needle is suspended by a very light cocoon fibre. The whole instrument can be turned about its vertical axis, and a quadrant graduated to degrees upon the base allows the amount of rotation to be accurately measured, and the laws of the sine galvanometer investigated.

Of resistance-boxes, this list offers a variety. Fig. 7 is a combination Wheatstone bridge and resistance-box having twelve coils, and, in addition, bridge-coils of 10, 100, and 1,000 ohms on a side, thus giving a total range of measurement of from .01 of an ohm to 111,000 ohms. Separate keys, properly connected, for battery and galvanometer, are mounted on the same top with the set.

Queen's "New Model" reading telescope (Fig. 8) will please many who have long been seeking something of the kind, reliable, and at the same time reasonable in price.

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SCIENCE

[Entered at the Post-Office of New York, N.Y., as Second-Class Matter.]

NINTH YEAR.
VOL. XVII. No. 431.

NEW YORK, MAY 8, 1891.

SINGLE COPIES, TEN CENTS.
$3.50 PER YEAR, IN ADVANCE.

PROTECTION FROM LIGHT[redacted]tion from Lightning

THE NEW METHOD STANDS UNCRITICISED.

"The main point which I would urge upon your consideration is that by giving the electrical energy something which experience shows it will readily dissipate, that is, a conductor of varying resistance and small size, we can but mitigate the effects of lightning-discharges, so long as the conservation of energy holds true. I will only repeat that I have so far found no case on record where the dissipation of such a conductor has failed to protect the building under the conditions already explained."—*From paper read before the American Institute of Electrical Engineers, April 21.*

PRESS COMMENTS:

"If the theory advanced by Mr. N. D. C. Hodges, as to the cause of the damage and destruction of buildings when struck by lightning, and the method proposed to avert such damage is correct, that gentleman's discovery will properly rank as one of the most scientific and useful in the history of electricity. His reasoning seems to be correct, and it will be interesting to note the result of a practical test of his system of protecting buildings from damage by lightning. If he is right, then there will be no excuse for allowing property to go unprotected from lightning's destructive power. It is well to be prepared at all times for the unexpected, and lightning certainly possesses, more than anything else that we know of, a good deal of the element of uncertainty. It may, or may not strike one's property, and very frequently the lightning rods in vogue at the present time are no better than none at all. A reliable method of protection against damage to property by lightning is something very much desired, and if Mr. Hodges has discovered a means of accomplishing this result, his name will become intimately linked with that of the immortal Ben Franklin."—*Electrical Age, May 2.*

"The paper by Mr. N. D. C. Hodges, printed in this issue, on his new system of protection against lightning, adds some details to the description we gave of his ideas and methods two or three months ago. Mr. Hodges, having noticed that certain conditions and results attend a lightning stroke, has come to the conclusion that what is wanted is a protector that will dissipate the charge by means of its own dissipation. Such apparatus as he proposes would evidently be cheap, and there should be no difficulty in finding out whether the Hodges device is a protector that protects."—*Electrical Engineer, May 6.*

"As we understand it, the rod will consist of appropriately sized wire-pieces—which are to be fused or volatilized by the passage of the lightning; the energy being thus harmlessly converted. Undoubtedly there is room for improvement in the form of protector, conductor or discharger (or by whatever name we may call it) to be used in dealing with discharges of such high potentials as exist in lightning flashes. The really important part of this new invention is, that in its theory, it emphasizes the fact that the seat of the electrical energy is, and must be—not in the cloud or in the earth, just preceding a flash of lightning, but in the air column between cloud and earth."—*American Meteorological Journal, April.*

PROSPECTUS.

47 LAFAYETTE PLACE, NEW YORK, March 9, 1891.

It is proposed by the owners of letters patent dated Dec. 16, 1890, on an improved method for protecting buildings from lightning, etc., to organize a company for the handling of said patent and all improvements; and subscriptions are requested on the following terms and conditions:—

1. A company is to be organized with a capitalization of $10,000, in 1,000 shares of $10 each, fully paid in at par, the company to be organized in such State as the subscribers may determine by vote when all shares have been subscribed for, and with a charter to contain a provision that the amount of capitalization shall never be increased.

2. This $10,000 is to be used as working capital; and the object of the company will simply be to place licenses with responsible persons, corporations, or sub-companies, al such rates of royalty as may be agreed upon by a majority vote.

3. In lieu of any stock or cash payment to the inventor for his patent, the inventor will give said company the exclusive control of his said inventions in consideration of the payment to him by said company of one-third of the gross royalty receipts.

The officers of the company shall be elected by a majority vote of the stockholders without reserve. No stock shall be given to anybody for services or any thing else except actual cash payment at par into the treasury.

No subscriptions will be binding until the full number of 1,000 shares has been subscribed for.

Subscriptions are solicited in amounts from five shares upwards. The list opens with subscriptions for **one hundred and five** shares.

The names of those who have subscribed will be sent to any intending subscriber upon application.

N. D. C. HODGES.

To dissipate the energy of a lightning discharge,—to prevent its doing harm,—it is necessary that something should be placed in its path upon which its energy (capacity for causing damage) may be expended. The Patent Lightning Dissipater is specially designed to serve this purpose, and will be sent prepaid, with full directions for its application, to any part of the United States, not previously taken by agents, on receipt of $5.00.

Correspondence solicited.

AGENTS WANTED.

N. D. C. HODGES,
47 Lafayette Place, N. Y.

BUSINESS OPPORTUNITY.

There is a good chance for the right man as Manager of the

LIGHTNING PROTECTION COMPANY,

which is being formed to operate under broad patents. The new method will certainly revolutionize the whole system of protecting property from lightning.

Those interested should send for report of the meeting of the American Institute of Electrical Engineers, held April 21.

Local companies are already forming to operate under licenses from the parent company, and we should be glad to hear from any who would care to consider entering this new field.

Correspondence is solicited with those desiring further information.

N. D. C. HODGES, 47 Lafayette Pl., N.Y

CALENDAR OF SOCIETIES.

Biological Society, Washington.

May 2.—Theo. Gill, On the Classification of the Apodal Fishes; B. T. Galloway, Recent Progress in the Study of Plant Diseases; Frank Baker, Notes on Dwarfs; Charles Hallock, Distribution of Fishes by Underground Water-courses; F. C. Test, Notes on the Dentition of Desmognathus; J. M. Holzinger, Incentives to Natural History Work.

New York Academy of Sciences.

May 4.—L. H. Laudy, Electric Meters.

Boston Society of Natural History.

May 6.—C. S. Minot, Evolution of the Head.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—Vols. I. and II. of Allen's "Commercial Organic Analysis." SCIENCE BOOK AGENCY, 47 Lafayette Place, New York.

THERE is an opening in this office for a college graduate with scientific tastes. *Science*, 47 Lafayette Place, New York.

WANTED—A situation in an Analytical Laboratory during the summer vacation. Can give good references. Address M. ADGATE, North College, Burlington, Vt.

WANTED—A position in some College, Normal School or Academy to teach Biology, Physiology, Comparative Anatomy, Histology, Embryology or Botany. A graduate of the University of Wisconsin. Have had four years' experience as a teacher. Address "BIOLOGIST," care SCIENCE.

WANTED.—All of Vol. I. of *Journal of Analytical Chemistry*, published at Easton, Penn. State price and condition. SCIENCE BOOK AGENCY, 47 Lafayette Place, New York.

WANTED—A position in a Summer School of Gymnastics to teach any one or more of the following named physical exercises, viz.: Fencing (to ladies especially), Sparring, Club Swinging, Wands, Chest Weights and Free Movements. Am prepared to offer very favorable terms to any school desiring such work. WILLIAM FINDLAY, Proprietor of Phila. Inst. of Phys. Cult., 1009 Arch Street, Philadelphia, Pa.

A HARVARD M.A., especially interested in Natural History, would like to learn of some outdoor occupation for the summer. Remuneration a secondary object. SUMMER, *Science* Office.

A CHEMIST, taking P. G. work in the Scientific Department of one of our best colleges, would like to negotiate for some industrial position, where his knowledge would be of avail. Can furnish best of references. R. S. W., Box 691, Amherst, Mass.

WANTED—A position to teach Electrical Engineering by a student from leading English and French and U. S. science schools, or would accept position as Consulting Electrical Engineer, Electrician, etc. Very highest testimonials. London & Hartford Publishing Co., N. Y. (International Press Department.)

WANTED.—A young man in college would like a position during the summer of 1891 in some scientific work, particularly Orinthology, either as an instructor or tutor, or in making collections or accompanying some scientific expedition. Can give good references. Address HUBERT L. CLARK, Amherst, Mass.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

For sale, or exchange for geological works, the following works in anatomy, all latest editions: Allan, Tuain, Gray, Leidy, Massey, and Rollestin's Forms of Animal Life. S. W. Williston, Lawrence, Kan.

Will exchange a new Thomson reflecting astatic galvanometer, about 6,000 ohms, made by Clark, Muirhead & Co., London, and costing £30, with 1-9, 1-99, 1-999, shunts, lampand scale, for a Weston voltmeter and ammeter, or arge Wheatstone bridge, dial pattern, or a portable testing outfit. Address G. A., *Science* Office, 47 Lafayette Place, New York.

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

SCIENCE

NEW YORK, MAY 8, 1891.

SOME POSSIBLE MODIFICATIONS IN THE METHODS OF PROTECTING BUILDINGS FROM LIGHTNING.[1]

I REMEMBER with what hesitation I ventured some months ago to explain to your fellow-member, Mr. T. C. Martin, my ideas on some possible modifications in the method of protecting buildings from lightning. But as he was kind enough to express the belief that there was something in what I had to say, I have ventured to come here this evening to explain my ideas to what must be an extremely critical audience.

To begin with, I have always belonged with those who have been sceptical as to the utility of lightning-rods as ordinarily placed on our houses. I was never able to understand, and cannot now, why, if a lightning-rod as ordinarily introduced was useful, the lightning should scent out a bad earth connection at so considerable a distance. I mean that I could understand the ordinary theory of the rod if invariably the electrical discharge followed the rod as far as its conductivity was good, only to leave it when the bad earth connection was reached.

I am aware that the advocates of the old form of rod point to the apparent beneficial effects of the Harris system as introduced on ships. This may be due to the possibility of making an especially good earth connection, or it may be due to there having been introduced on ships about the time that rods were introduced some other modification which has had a beneficial effect. I have some suspicions on this point, and find it recorded in the London *Electrical Review* that lightning does not play as destructive a part as it did forty or fifty years ago, and that even those ships unprovided with conductors have suffered less damage than a smaller number of ships experienced formerly. Not that modern vessels are exempt, but they seem to be struck in a manner which causes fewer fatal accidents, and in some cases even the effects of a lightning-flash have borne so little trace of their origin that they have been credited to the wilful act of some one on board.

Ordinarily a lightning-rod is regarded as a conduit or pipe for conveying electricity from a cloud to the ground. The idea is that a certain quantity of electricity has to get to the ground somehow; that if an easy channel is opened for it, the electricity will pass quietly and safely; but that if obstruction is introduced, violence and damage will result. This being the notion of what is required, a stout copper rod, a wide-branching and deep-reaching system of roots to disperse the charge as fast as the rod brings it down, and a supplement of sharp points at a good elevation to tempt the discharge into this attractive thoroughfare, are naturally guaranties of complete security.

I think Oliver J. Lodge has expressed well the difficulty that has always been present in my mind when I have read detailed descriptions of the effects of lightning. He says, in a paper published in the *Electrical Engineer* some time last June, that when, in spite of all precautions, accidents still occurred; when it was found that from the best-constructed conductors flashes were apt to spit off in a senseless manner to gun-barrels and bell-ropes, and wire fences and water-butts, — it was the custom to more or less ridicule and condemn either the proprietor or its erector, or both, and to hint that if only something different had been done, — say, for instance, if glass insulators had not been used, or if the rod had not been stapled too tightly into the wall, or if the rope had not been made of stranded wires, or if copper had been used instead of iron, or if the finials had been more sharply pointed, or if the earth plate had been more deeply buried, or if the rain-fall had not been so small, or if the testing of the conductor for resistance had been more recent, or if the wall to which the rod was fixed had been kept wet, — then the damage would not have happened. Every one of these excuses has been appealed to as an explanation of a failure; but because the easiest thing to abuse has always been the buried earth connection, that has come in for the most frequent blame, and has been held responsible for every accident not otherwise explicable.

I have to say, therefore, that up to about two years ago I was simply in the dark as to what was the matter with lightning-rods. I could not accept the reasoning set forth in the report of the Lightning-Rod Conference or in any of our books. It did not seem to me that the arguments in support of the ordinary lightning-rod were logical. It seemed to me that there was something that we did not understand.

About two years ago one of the oil-tanks at Communipaw or Bayonne, just off the New Jersey Central Railroad, was struck by lightning; and, as I pass that way each day, my attention was again called to the question how we should protect our buildings from lightning: and one evening, taking up Silvanus P. Thompson's little book on electricity, I think it was, to see what he had to say about lightning, I re-read the ordinary theory of the formation of the high potentials that are manifested in lightning-discharges.

This theory is simply this: that if, in the cloud, there is a certain quantity of electricity distributed on a given mass of fine mist, it will exist there at a certain potential, depending on the capacity of this finely divided matter. Now, if these mist-particles coalesce into raindrops, the theory points out that there would be a decrease in the electrical capacity, and a consequent increase in the potential of the charge. It occurred to me immediately, that, if this theory had any foundation in fact, it ought to be possible to reverse the operation on the surface of the earth; that is, to receive the lightning-discharge on some large body, which would then be broken up into fine particles of vapor, which would have a considerably greater electrical capacity, and that the potential of the discharge would thereby be materially reduced, and the effects of the lightning mitigated. This was my hypothesis to work upon, and I immediately began to look through the records to see what actually happened in the case of lightning-discharges, and to see if there was any support in fact for my hypothesis.

The first book at hand was Sir William Thomson's "Pa-

[1] A paper, by N. D. C. Hodges, read at the fifty-sixth meeting of the American Institute of Electrical Engineers, New York, April 21.

pers on Electricity and Magnetism," and I found that he described in detail the case of a farmhouse in Scotland, which was struck by lightning, and in which this very dissipating effect took place; that is, the bell-wires were dissipated, — an occurrence which, as you know, is extremely common when a lightning-discharge takes place. I went on through the records, and found numberless cases of this, the oldest being that of the dissipation of the metal covering on the wooden shield of some Greek warrior. I mention this case as of interest, as it brings out a very fortunate circumstance, that when thin metal is dissipated against wood or even against plaster, no harm results to the wood or plaster. Of course, you know that it has been somewhat discussed whether this action is a dissipation through the heating of the metal, or whether it is a cold dissipation — a breaking-up into particles, as it were — of the metal. On this point I have nothing to say.

But as I went on through the records I could not make the facts accord satisfactorily with my hypothesis. The dissipating action that I was looking for certainly took place, and is a very common accompaniment of lightning-discharges, but in spite of it, there was damage to the building. It was only after a considerable reading of the records that it gradually dawned on me that I had found no case where damage to the building occurred on the same level with the dissipated conductor.

Let me describe here in Franklin's own words a typical case of the action of a small conductor dissipated by the discharge.

Franklin, in a letter to Collinson read before the Royal Society, Dec. 18, 1755, describing the partial destruction by lightning of a church-tower at Newbury, Mass., wrote: "'Near the bell was fixed an iron hammer to strike the hours; and from the tail of the hammer a wire went down through a small gimlet-hole in the floor that the bell stood upon, and through a second floor in like manner; then horizontally under and near the plastered ceiling of that second floor till it came near a plastered wall; then down by the side of that wall to a clock, which stood about twenty feet below the bell. The wire was not bigger than a common knitting-needle. The spire was split all to pieces by the lightning, and the parts flung in all directions over the square in which the church stood, so that nothing remained above the bell. The lightning passed between the hammer and the clock in the above mentioned wire, without hurting either of the floors, or having any effect upon them (except making the gimlet-holes, through which the wire passed, a little bigger), and without hurting the plastered wall, or any part of the building, so far as the aforesaid wire and the pendulum-wire of the clock extended; which latter wire was about the thickness of a goose-quill. From the end of the pendulum, down quite to the ground, the building was exceedingly rent and damaged. . . . No part of the aforementioned long, small wire, between the clock and the hammer, could be found, except about two inches that hung to the tail of the hammer, and about as much that was fastened to the clock; the rest being exploded, and its particles dissipated in smoke and air, as gunpowder is by common fire, and had only left a black, smutty track on the plastering, three or four inches broad, darkest in the middle, and fainter towards the edges, all along the ceiling, under which it passed, and down the wall."

I would thus formulate what seems to be true,— that a conductor which can be easily dissipated by a lightning-discharge protects the building to which it is attached between two horizontal planes, the one passing through the upper end of the dissipated conductor, and the other through the lower end; and it is this one point that I would urge upon the consideration of the Institute.

I have taken the time of the Institute to tell how I reached this conclusion; but, as must always be, I reached it by making some false digressions. So far as I know, therefore, a conductor such as I have here — a conductor made of light copper ribbon, so that seventy-five feet of it will weigh only a pound, and made in sections two feet long, which shall be tacked to the building from its ridge-pole to the foundation, the joints being made of low conductivity by the insertion of insulating washers — will protect the building. The conductor will be destroyed by the discharge. Its destruction can take place even against a plastered wall without injury to the wall; but no other harm will occur so far as the conductor extends in a vertical direction. There is no need of the conductor following the shortest course to the ground. There is no need of providing a good earth connection. I can see no difference between the two ends of the metallic ribbon. You do not attempt to make a good connection at the top with the dielectric, and I do not see why you should attempt to make a good connection at the bottom. In no case on record of the protecting influence of dissipatable conductors has this protecting influence depended upon there being a good earth connection. Of course, the ribbon should not be boarded over. Free gun-powder burns harmlessly enough, but it causes damage when burned in a confined space; and the dissipation of a conductor presents similar phenomena.

It would not do to run such a conductor as I suggest here part way down the building, and then make it turn up again before its final descent to the ground, as in such a case there would probably be a line of disaster from the point where the upward turn began.

Doubtless numerous improvements can be suggested, but letting this stand as the main point of what I have to say,— that a dissipatable conductor protects,— it may be of interest to consider why it protects. But here you will understand perfectly well that, while I can offer certain explanations which seem fairly plausible to me, it is not in the nature of things that I should have gotten at the whole truth.

In order to destroy a building in whole or in part, it is necessary that work should be done; that is, energy is required. Just before the lightning-discharge takes place, the energy capable of doing the damage which we seek to prevent exists mainly in the column of air extending from the cloud to the earth in some form that makes it capable of appearing as what we call electricity. We will therefore call it electrical energy. What this electrical energy is, it is not necessary for us to consider; but that it exists there can be no doubt, as it manifests itself in the destruction of buildings.

The problem that we have to deal with, therefore, is the conversion of this energy into some other form, and the accomplishment of this in such a way as shall result in the least injury to property and life. When lightning-rods were first introduced, the science of energetics was entirely undeveloped; that is so say, in the middle of the last century, scientific men had not come to recognize the fact that the different forms of energy — heat, electricity, mechanical power, etc.— were convertible one into the other, and that each could produce just so much of each of the other forms, and no more. The doctrine of the conservation and correlation of energy was first clearly worked out in the early part of this century. There were, however, some facts known

in regard to electricity a hundred and forty years ago, and among these were the attracting power of points for an electric spark, and the conducting power of metals. Lightning-rods were therefore introduced with the idea that the electricity existing in the lightning-discharge could be conveyed around the building which it was proposed to protect, and that the building would thus be saved.

The question as to the dissipation of the energy involved was entirely ignored, naturally; and from that time to this, in spite of the best endeavors of those interested, lightning-rods constructed in accordance with Franklin's principle have not furnished satisfactory protection. The reason for this is apparent when it is considered that this electrical energy existing in the atmosphere before the discharge, or, more exactly, in the column of dielectric from the cloud to the earth, reaches its maximum value on the surface of the conductors that chance to be within the column of dielectric; so that the greatest display of energy will be on the surface of the very lightning-rods that were meant to protect, and damage results, as so often proves to be the case. The very existence of such a mass of metal as an old lightning-rod only tends to produce a disastrous dissipation of electrical energy upon its surface,—"to draw the lightning," as it is so commonly put.

Having cleared our minds, therefore, of any idea of conducting electricity, and keeping clearly in view the fact that in providing protection against lightning we must furnish some means by which the electrical energy may be harmlessly dissipated, it seems clear why it is that the use of sufficient energy to dissipate a pound of copper, leaves not enough to do harm to other objects around. The question naturally arises how much energy there is available. There is stored up in each cubic centimetre of the column of dielectric from the cloud to the earth, just before the lightning-discharge, an amount of electrical energy given by the expression $\frac{1}{8\pi} K E^2$, where K is the specific inductive capacity of the dielectric, and E the electromotive intensity, both in electrostatic units. This expression is given on p. 156, Vol. I., second edition, of Maxwell's "Treatise on Electricity and Magnetism." Substituting the values of K and E, and reducing, we find that the amount of energy involved amounts very nearly to one foot-pound for each cubic foot of air. This is, of course, a maximum value.

When this amount of energy is reached in any cubic foot, the air breaks down, and the discharge takes place, and the amount of energy per cubic foot in the column of dielectric reaching from the cloud to the earth cannot be uniform, but must reach this maximum value along a central core, and diminish gradually from this value to nothing at a considerable distance. If we consider that the dissipation of this electrical energy takes place throughout the whole length of the column of dielectric from the cloud to the earth, we shall see that all the energy that we have to care for in our lightning-rod is that existing in the section of the column contained between two surfaces passing through the top and foundation of our house respectively. I have said two surfaces, as doubtless they are not planes: presumably they are two equi-potential surfaces.

I am now coming to a point that I want to make clear, and that is, that, according to the usually accepted theories of electrical action, this electrical energy is gradually stored up in the column of dielectric from the cloud to the earth, and that it is distributed in this column with the greatest amount per cubic foot along some central core, this amount not exceeding one foot-pound per cubic foot, and that this process can be continued until the stress is so great that the air breaks down, when what we call a discharge of lightning takes place, and the electrical energy disappears, of course only to take on some other form. You may say that the electricity travels from the cloud to the earth, or from the earth to the cloud, whichever you please; at any rate, there is an electrical action in a vertical direction, the discharge being supposed vertical. I will ask, however, whether it is not true that the energy involved travels along the equi-potential lines; that is, travels in the main horizontally. It seems to me that it shrinks in, as it were, from the considerable column or ellipsoid of dielectric upon the central core, where it manifests itself as heat and light in the electrical flash. It will, then, be clear how it is that in providing a body upon which the dissipation of energy shall take place we have to guard against something not coming from above or below, but coming from the side, and that this may be the explanation of why it is that, so far as I have been able to find, a dissipatable conductor protects the building between two essentially plane surfaces passing through its upper and lower ends.

Have we not, then, in the lightning-discharge, another illustration of the relation between light and electricity? If we suppose for a moment that in place of the central core where the electrical energy is dissipated we were to place some hot or luminous body, this body would constantly radiate energy into the surrounding space, and at any instant there would be in each cubic foot of this surrounding space a certain amount of radiant energy. Now, if this process could be brought to a standstill at any moment, would not the conditions be in some degree similar to those just preceding the electrical discharge? There would be need of a certain force along the central core to maintain the various stresses throughout the surrounding medium; and if this central force were to be taken away, as it is taken away when the dielectric breaks down and the spark passes, the stresses could no longer be maintained, and there would be a vibratory transmission of the energy back upon the central core.

But let all this be as it may, the main point which I would urge upon your consideration is that by giving the electrical energy something which experience shows it will readily dissipate, that is, a conductor of varying resistance and small size, we can but mitigate the effects of lightning-discharges, so long as the conservation of energy holds true. I will only repeat that I have so far found no case on record where the dissipation of such a conductor has failed to protect the building under the conditions already explained.

NOTES AND NEWS.

IN England, says *The Illustrated American*, the only venomous snake is the viper, which frequents chalky districts, and is not to be found all over the country. Perhaps these vipers are the most common and vicious of the smaller snakes, seldom growing longer than two feet. They abound not only in warm countries, where forests are thick and men are few, but also in the coldest regions of Sweden, Norway, Russia, and even Siberia, where a great many exist, owing to a stupid superstition among the peasants that if a viper is killed a terrible misfortune will soon befall the rash slayer. The California viper builds itself a little mud hut, just its own length, and probably half an inch thicker than its own body. It is made of earth, fine gravel, and sometimes leaves are mixed in the construction of this curious abode. It is lined with a soft, silky substance, finer than cotton and silkier than down. At each end there are two little doors, and when *monsieur*

la maitre is half-way in, one shuts, and when all the way in, the other closes, leaving the master of the house as isolated and exclusive as Robinson Crusoe on his desert island. One of these "viper shells," brought from California lately, was so thoroughly sun-baked and hardened that though more than two feet long it could be dropped on the floor without breaking.

— A "security" elevator soon to be introduced is described as follows by a member of the Polytechnic Society of Kentucky: The framework of its hatchway is supplied, at each of the two sides or ends which stand at right angles to the cage entrance, with a pair of wood studs extending from the bottom to the top of the hatchway, and with a space of seven-eighths of an inch between them. Into one of each pair of these studs is casemented a series of horizontally arranged steel bolts ten, or it may be twelve, inches apart. These bolts are movable, and when pushed seven-eighths of an inch outward their ends project across the spaces between the studs; and as long as they remain thus across, nothing, of course, can pass up or down within these spaces. When, however, they are drawn back into their casements, the spaces are vacant, and any thing can ascend or descend through them. The framework of the cage is constructed on a central wrought iron beam, the ends of which project into these spaces. When the cage is at the bottom of the hatchway, the bolts are within their casements; but the instant its central beam passes the two bolts next to it, these, by its movement upwards, and through a device which is as immediate as it is simple and positive, are projected out of their casements across the spaces underneath the beam. When the conductor has reached any point at which he wishes to descend, he lays one of his hands against a button and through a continued pressure brings into action a device similar in nature to the one which, through the movement of the cage upward, pushed the bolts out across those spaces, and through the movement of the cage downward each successive pair of bolts next underneath are drawn back into their casements. Various ingenious devices are introduced to avoid the chance of accidental pressure on the button.

— The separation of magnetic iron-ore from the rock with which it is associated, says *Engineering*, has often been attempted with more or less success. Even if only a part of the rock is eliminated, there is a substantial gain, particularly in cases where the ore has to be transported long distances from the mine to the blast furnace. But if the gangue contain phosphorus or sulphur, as it often does, so long as any appreciable amount of it remains, the iron made from the ore is unfitted for use in the Bessemer process, and sells at a lower price than it would if it had been freed from these impurities. It has therefore been the object of inventors to produce a separator which would remove the rock so effectually that not more than .05 per cent of phosphorus should remain, even when the iron is associated with a gangue of phosphate of lime. The difficulty found was, that immediately the pulverized ore was magnetized all the particles clung together, entangling between them fragments of rock, which could only escape with difficulty, if at all. Various means were tried by vibration and alternate magnetization and demagnetization to permit the rocky particles to get away from the embrace of the metal. Whatever measure of success might be attained in this way, and the results were far from being fully satisfactory, it did not extend to the case of particles formed partly of iron and partly of rock. These were attracted by the magnet and remained with the metal. In the Monarch magnetic ore separator, however, invented by Messrs. Ball and Norton, a very ingenious method has been devised of freeing the rocky particles, and of discriminating between those that are entirely metallic, and partly metallic and partly earthy. The crushed ore is fed on to the surface of a rotating paper drum. Within this drum, and occupying less than half its circumference, is a multipolar magnet, having twelve poles alternately north and south. Immediately the metallic particles touch the drum they become polarized, and hang on by one end. In passing from the first pole to the second of the stationary magnet the opposite pole of each particle is attracted, while that hitherto attracted becomes repelled. Consequently the fragment turns end for end, and in so doing any rock clinging to it has the chance to escape downwards under the action of gravity. This effect is repeated some twelve times. After passing half way round one drum the ore is delivered on to a second, running at a higher speed, and here centrifugal force aids the separation. The same process of turning over the fragments is repeated, and should any of them happen to be partly of rock and partly of iron they are sure to be thrown off and eliminated. The final product is almost entirely of iron, the phosphorus being reduced to .05 per cent.

— "It is, I think, well to record the following observations of the intelligence of the thrush," says John Hoskyns-Abrahall in a letter to *Nature* of April 28. "The first happened on June 28, 1865. I then saw, from the windows that look out on the little lawn north of my house, a thrush steadily 'stepping westward' in front of the hedge that parts the lawn from the public road. The bird seemed to be intentionally making for a gravel path that, after passing almost close to the windows, bends to the north-west, toward the small gate of my front garden. It was bearing something in its bill. On coming to the path it attempted to break this on a stone. It did not succeed. It then tried another stone. This time it succeeded. Thereupon it flew away. On the spot I found a remarkably big stone embedded in the path, and round it were scattered bits of snail shell. The bird had eaten the snail. The second of the observations I would note, and the more striking of the two, happened on June 5, 1890. I then was viewing the gravel path from the westernmost of the four windows. Just beneath me, standing on the path, was a female thrush. She had succeeded in breaking a snail shell. She had the snail in her bill. But, despite of vigorous efforts, she could not swallow it. Up hopped a male thrush. Standing before the female, he opened his bill. She dropped the snail into his bill. He chewed the snail. He dropped it back into the female's ready bill. She swallowed it. The pair blithely trotted off, side by side, toward the small gate. I saw them no more."

— Mr. W. H. Goodyear, writing to the New York *Nation* from Keneh, Upper Egypt, on March 17, says that Mr. Petrie has unearthed at Maydoom "the oldest known Egyptian temple and the only Pyramid temple ever found." Apart from the Temple of the Sphinx at Ghizeh, this building is also "the only temple of the Old Empire so far known." It was buried under about forty feet of rubbish. It lies directly at the centre of the eastern base of the Pyramid, on the side facing which it has two round-topped obelisks. "Obelisks and temple chambers so far entered," says Mr. Goodyear, "have the plain, undecorated style of the Old Empire, as shown by the Temple of the Sphinx, but hieratic inscriptions in black paint found within fix the name of Seneferoo as builder, and confirm the supposition to this effect hitherto based on the fact that tombs near the Pyramid contain his cartouche. Seneferoo is the king connecting the third and fourth dynasties, and variously placed in either. According to computations of Mariette and Brugsch, the antiquity will be about 4000 B.C., or earlier." On Tuesday, March 10, Mr. Petrie's workmen reached a platform which appeared to be a causeway terminating with two obelisks at the base of the Pyramid. "In the forenoon of Wednesday," continues Mr. Goodyear, "a workman came to say that an opening had been found under the platform on the side next the Pyramid. This proved to be the top of a doorway choked by detritus, through which Mr. Petrie crawled into an interior of three chambers and discovered the inscriptions mentioned. I had the pleasure of following him. Mr. Petrie thought the apartments had not been previously entered for about three thousand years — that is to say, that the rubbish fallen from the pyramid had choked the entrance about three thousand years after construction. A friend who was with me noticed on the floor some dried wisps of papyrus, a plant now extinct in Egypt. The chambers thus far found are so filled that one cannot stand erect in them, and a door at the end of the third chamber is blocked by large stones. Over all lies an enormous mass of detritus, whose removal by Arab diggers is now in progress. I had the pleasure next day of carrying the news of Mr. Petrie's find to the gentlemen of the Egypt Exploration Fund at Beni-Hassan, and of witnessing their unaffected delight over it."

— The United States Hydrographic Office reports that this month, for the first time in several years, there is not a single obstruction along the coast that is dangerous to sea-going vessels, thanks to the work of the United States Steamship "Yantic," in command of Commander C. H. Rockwell, U.S.N. The last wreck destroyed was the schooner "Ada P. Gould," near Cape Charles light-ship, April 11 and 12, and a final visit was paid on April 24 to the scene of the collision between the "Vizcaya" and "Hargraves," off Barnegat. The "Yantic" has been engaged in this work for seventy-six days, of which thirty-six were spent at sea. She has steamed and sailed about 3,000 miles and has anchored in the open sea, in various depths along the coast, twenty-two times. Six wrecks have been destroyed, one has been dismantled, and a permanent danger mark erected; many spars have been blown up and set adrift, and five wrecks have been sought for with care and reported as no longer existing as obstructions. Thirty-three service torpedoes and seven exercise torpedoes have been expended in the work, and no casualties or accidents of any kind have occurred. The following is an extract from Commander Rockwell's report: "Officers and crew were carefully instructed and prepared for this hazardous and important duty, and strong wrecking crews were detailed from the best men in the ship for the working boats. There was always danger of staving a boat, and our boats received considerable injury and hard usage in this way, but by practice the men became very expert, and were generally successful in avoiding danger. I take pleasure in commending officers and men for their zeal and earnestness."

— Capt. Petersen, of the Swedish bark "Eleanora," reports to the United States Hydrographic Office that between 7 and 8 P.M., March 13, he experienced a submarine earthquake in the volcanic region of the Atlantic west of St. Paul Rocks. The ship was heading north-west, going about three knots, with a light easterly wind and calm sea, when a noise was heard on the port side, like a heavy surf, and almost immediately the sea began to bubble and boil like a huge kettle, the broken water reaching as high as the poop-deck. No distinct shock was felt, but after the disturbance struck the ship she continued to tremble as long as it lasted. After about an hour it ceased for an hour and was then followed by another similar disturbance. A bubbling sound was all that could be heard and the water appeared foamy, but it was impossible, on account of the darkness, to say whether it was muddy. The next day weather and sea were as usual. Position at 8 P.M., 3° 47′ north latitude, 42° 03′ west longitude. The region from St. Paul Rocks to and including the Windward Islands is especially subject to earthquakes, and reports similar to the above are often received. In September, October, and November of last year a number of shocks were reported, of which the heaviest was the one at Barbadoes on Oct. 6, felt throughout the region between Demerara and Martinique. On Nov. 20, a severe shock was felt about 8° 45′ north latitude, 40° 28′ west longitude, aboard the American bark "P. J. Carleton," Capt. Crosbie. The sea became like a boiling pot, tumbling about in a seething mass and greatly confused, and a grating sensation was experienced, as though the vessel were going over a reef. Nov. 28, in 3° 00′ north latitude, 27° 00′ west longitude, a slight shock was experienced aboard the British ship "Walter H. Wilson," Capt. Sproul.

— John Le Conte, professor of physics at the State University, Berkeley, Cal., died April 29. Dr. Le Conte belonged to a family distinguished for having many members who have been interested in scientific work. He was the son of Lewis Le Conte, known for his contributions to the physical sciences as well as a naturalist, and was born in Liberty County, Ga., in December, 1818. He was graduated at Franklin College of the University of Georgia in 838, and at the New York College of Physicians and Surgeons in 1841. From this city he proceeded to Savannah, where he began the practice of the medical profession, but in 1846 he was called to the chair of Natural Philosophy in Franklin College, which he occupied until 1855. The following year he lectured on chemistry at the New York College of Physicians and Surgeons, and in 1856 he was appointed Professor of Natural and Mechanical Philosophy in South Carolina College, at Columbia, S.C. In 1869 he was appointed Professor of Physics and Industrial Mechanics in the University of California, and discharged the duties of that position until 1881. From 1876 to 1881 he held the office of president of the university in connection with his professorship. At the expiration of that period he retired to the chair of physics, which he occupied until his death. He was a brother of Professor Joseph Le Conte, the geologist.

— Dr. Joseph Leidy died April 19. Dr. Leidy was born in Philadelphia, Sept. 9, 1823. In 1844 he received the degree of doctor of medicine from the University of Pennsylvania, but soon abandoned the practice of his profession for more congenial pursuits. From 1846 to 1852 he gave private lectures on anatomy and physiology. In 1853 he was made professor of anatomy in the University of Pennsylvania, a position in connection with which he did the major part of his scientific work. Aside from his work in anatomy he did much in zoölogy and paleontology. In 1884 Dr. Leidy was made director of the biological department in the university. As an indication of the extent of his investigations it may be mentioned that his papers on biological subjects number more than eight hundred.

— Freiherr von Benko, captain in the Austrian Navy, has published a pamphlet, we learn from the April *Scottish Geographical Magazine*, in which he calls attention to the singular fact that until half a century ago the inhabitants of the Philippines were a day behind those of neighboring countries in their reckoning. It is easy to understand that the time on the meridian opposite to ours must differ by twelve hours, but who shall say whether those twelve hours are to be added or subtracted from our reckoning? Practically this has generally been settled by the first discoverers, according as they sailed eastwards or westwards. Legaspi, the conqueror and colonizer of the Philippines, sailed to the islands from the east, and brought what may be called the eastern date with him. Later on, however, when the Pope divided the world between the Spaniards and the Portuguese, giving the former the half lying beyond a meridian passing 100 leagues west of the Azores (afterwards removed to 370 leagues) the islands, owing to the inability of navigators in those days to calculate the longitude with any approach to accuracy, remained in the hands of the Spaniards, and the date was changed to that of their American possessions. But, in 1844, the governor-general of the Philippines decreed that "considering it convenient that the mode of reckoning days in these islands shall be uniform with that prevailing in Europe, China, and other countries situated to the east of the Cape of Good Hope, . . . I ordain, with the assent of His Excellency the Archbishop, that, for this year only, Tuesday, December 31st, be suppressed, and that the day following Monday the 30th of the same month be styled Wednesday, January 1st, 1845." That the date has been made to conform with that of Eastern countries is a circumstance not generally known, as Freiherr von Benko proves by quotations from geographical authors and encyclopædias, among others Meyer's "Konversation Lexikon."

— So far as is at present known, says *Nature*, the first person who kept a record of the weather was Walter Merle. He did so for the years 1337 to 1344, and his manuscript on the original vellum still exists. Thanks to the courtesy of the officials of the Bodleian Library, Mr. G. J. Symons has had this manuscript photographed, and reproductions of the ten large photographs, with a full translation (the original is in contracted Latin), some particulars as to Merle, and a list of the subscribers, are to be given in a handsomely printed volume. Mr. Symons wishes to call attention to the fact that no one will be able to obtain a copy who does not apply for one before May 1. Except ten copies reserved for subscribers too distant to apply before that date, not a single copy in excess of those subscribed for will be printed.

— Mr. William Beutenmüller has recently been appointed curator of the department of entomology in the American museum of natural history in Central Park, New York City.

— Mr. C. H. Tyler Townsend has just taken the post of entomologist at the agricultural experiment station at Las Cruces, New Mexico.

SCIENCE:

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

SORGHUM AND SUGAR BEETS IN KANSAS.

THE Agricultural Experiment Station at Manhattan, Kan., has been engaged for three years in a series of investigations upon sorghum, the principal aims being: (a) the attempt to find better varieties of sorghum for producing sugar; (b) to improve well-known and approved sorts; (c) to secure both early and late maturing kinds of good quality, especially the former, in order to lengthen the working season.

Bulletin 16 of this station, for December, 1890, gives the results of this work for 1890, including comparative tests of a large number of varieties, with analysis of their juice; attempts to improve seed by selection, trials of fertilizers, and a study of smut in sorghum. The same station has also established a series of experiments in the comparative culture of sugar beets, the results of 1890 being given in the bulletin referred to. The season was unfavorable to both sorghum and sugar beets, on account of both heat and drought.

Following is the station's summary of the results obtained as to sorghum.

1. The season of 1890 was very unfavorable to sorghum, owing to deficient rainfall and intense heat during the early summer, followed by cool, wet weather, culminating in an unprecedented killing frost Sept. 13. This frost was so exceptional as to date, and so erratic in distribution, its limit bearing no relation to isotherms or latitude, that it gives no ground for the conclusion that it was too far north for successful sugar manufacture from sorghum. Notwithstanding this, the tables show that the standard varieties maintained a good, though lower, standard of excellence.

2. The selection of seed with a view to improvement of varieties was almost wholly prevented by the early frost. A comparison of the results obtained for three years in selection of specially good canes lends encouragement to the hope that the standard of sugar-content may be permanently raised by this means.

3. A comprehensive experiment to test the effect of fertilizers on sorghum has shown no marked results this year, as was to be expected in view of the conditions of growth. The experiment will be continued from year to year, the same fertilizers being applied to the same plat throughout.

4. In view of the occurrence of two varieties of smut in the plats this year, caution in the introduction of new varieties is urged, lest destructive contagious diseases be brought in at the same time.

5. Crossing of varieties deteriorates the crop, so far as the experiments have gone.

The results of the experiments with sugar beets are as follows.

1. The sugar beets grown do not appear to be of as good quality as those reported to have been produced in other parts of Kansas and in Nebraska. This may have been due to the unusually unfavorable climatic conditions of last summer, or to unsuitability of soil.

2. Analysis of individual beets indicated that maturity, more than size, determined the sugar-content of the beet. A brown epidermis accompanied high per cent of sugar. As far as the observations went, a high weight of leaves, as compared with the roots, was no evidence of high sugar-content, but rather the reverse.

THE MERCURIAL PRESSURE-GAUGE ON THE EIFFEL TOWER.

THE new mercurial pressure-gauge devised by M. Cailletet and erected at the Eiffel Tower is an instrument of much scientific interest. The only instruments by which high pressures in gases or liquids can be registered with accuracy are very long vertical pressure-gauges. A gauge of this type, more than three hundred feet in height, was set up by M. Cailletet some years ago, first on the side of a hill, and afterwards in an artesian well. Several scientific men imitated this method of gauging high pressures, but the difficulty of handling and experimenting upon an instrument under conditions so unfavorable, threw considerable doubt upon the accuracy of the results obtained. The Eiffel Tower afforded a unique opportunity for setting up a pressure-gauge 984 feet high, every part of which should be accessible and open to observation. Thanks to the liberality of M. Eiffel, says *Engineering*, the task of constructing and fixing an instrument on so gigantic a scale has actually been now accomplished.

With a gauge of this height pressure up to four hundred atmospheres can be obtained, but it is manifestly impossible to use the customary glass tube. Recourse has, therefore, been had to a tube of soft steel of about one-sixth of an inch internal diameter, connected at the bottom of the tower with a reservoir containing mercury. By pumping water into the reservoir, the mercury in the tube can be gradually raised to the top of the tower.

A difficulty, however, arose from the slanting position of the columns supporting the tower, which prevented the tube being vertical. From the base of the tower to the first platform, a height of about 197 feet, the tube was therefore placed against the inclined plane of one of the rails of the lift, an iron staircase running beside it. Between the first and second platforms, which are separated by about the same interval, the apparatus was fixed to one of the helicoidal staircases. As this staircase is divided into several sections, not in the same vertical plane, on account of the obliquity of the column, the tube is similarly divided, and bends as it passes from one staircase to the other, sufficient slope being allowed for the descent of the mercury when the pressure is reduced. From the second platform to the top the tube is arranged in the same way, following the two vertical staircases, and is thus easily accessible from top to bottom.

The steel tube being opaque, the level of the mercury cannot be directly read off. Cocks with conical screws, each communicating with vertical glass tubes, are arranged at equal distances, about every ten feet, parallel with and alongside the tube. Each glass tube has a scale, carefully marked off on polished wood, which has been selected because it is very slightly affected by changes of temperature. It is adjusted by a rubber band to the metal framing, and leather rings compressed by a screw keep the cock tight. When one of the cocks is opened the interior of the steel tube is placed in communication with the corresponding glass tube. As the mercury rises in the steel tube, it penetrates into and acquires the same level in the glass tube alongside.

From the bottom of the tower to the first platform, the steel tube, as already mentioned, is in an inclined position, and the series of glass tubes placed vertically across it. These sections of glass tube are about ten feet long, each furnished with its scale and the cock communicating with the main steel tube; thus the pressure in any given glass tube is limited to its length of ten feet. The scales are marked in metres and centimetres, so that the head

may be read with the utmost accuracy. The tubes and scales are protected from the weather by wooden hinged casings, which can be opened at will.

To obtain a given height or pressure at a given moment, the cock of the corresponding glass tube must be opened, and the hydraulic pump set to work. When the mercury reaches the cock, it rises at the same time in both the steel and the glass tube. By working the hydraulic pump slowly, it can be brought exactly up to the required level, but if the mark be overshot, a certain quantity of water under pressure is allowed to escape near the pump at the bottom. This arrangement is carried out in the laboratory at the foot of the tower. The necessary communication between the two operators, one at the bottom and the other at any required height, is effected by means of a telephone which the ascending or descending operator carries with him, and through which he can speak with those in the laboratory below. If the mercury rises by mistake above the top of any one of the glass tubes it returns to the foot of the tower through an overflow pipe.

As the graduated scales behind each glass tube are not always vertically superposed, their readings are harmonized by means of two connected reservoirs of water joined by an India-rubber tube. The horizontal plane for the base of each scale corresponding to the upper level of the preceding scale can be ascertained from this artificial level.

A laboratory has been erected in the west pillar of the tower, containing the hydraulic force pump, the mercury reservoir, the telephonic station, and other accessories. Among these is a metal gauge of large dimensions connected with the mercury under pressure. It is marked to scale to show first the pressure in atmospheres, and second the numbers corresponding to the different cocks up the tower. The operator is thus able to tell at once and beforehand into which glass tube the mercury ought to rise under a given pressure, and the right cock to get opened to show the level it has reached. To calculate the pressure according to the height to which the column of mercury is raised, the mean temperature of the column in each experiment must be found. This is done by measuring the variation in the electric resistance communicated by the column to the telephonic wire.

The apparatus here described will be found of the greatest use for making experiments on pressures hitherto impossible, and its value from a scientific point of view can scarcely be overrated. The thanks of all scientific men are due to M. Eiffel, who generously undertook the whole expense of constructing and setting up the pressure-gauge, and also to M. Cailletet, to whose skilful designs the success obtained is chiefly due.

PRECIOUS AND ORNAMENTAL STONES AND DIAMOND CUTTING.[1]

UP to the present time there has been very little mining for precious or semi-precious stones in the United States, and then only at irregular periods. It has been carried on during the past few years at Paris, Me.; near Los Cerrillos, N. Mex.; in Alexander County, N.C., from 1881 until 1888, and on the Missouri River near Helena, Mont., since the beginning of 1890. True beryls and garnets have been frequently found as a by-product in the mining of mica, especially in Virginia and North Carolina. Some gems, such as the chlorastrolite, thomsonite, and agates of Lake Superior, are gathered on beaches, where they have fallen from rock which has gradually distintegrated by weathering and wave action.

A very limited number of diamonds have been found in the United States. They are met with in well-defined districts of California, North Carolina, Georgia, and recently in Wisconsin, but up to the present time the discoveries have been rare and purely accidental.

Of the corundum gems (sapphire, ruby, and other colored varieties) no sapphires of fine blue color and no rubies of fine red color have been found. The only locality which has been at all prolific is the placer ground between Ruby and Eldorado bars, on the Missouri River, sixteen miles east of Helena, Mont. Here sapphires are found in glacial auriferous gravels while sluicing for gold, and until now have been considered only a by-product. Up to the present time they have never been systematically mined. In 1889 one company took the option on four thousand acres of the river banks, and several smaller companies have since been formed with a view of mining for these gems alone or in connection with gold. The colors of the gems obtained, although beautiful and interesting, are not the standard blue or red shades generally demanded by the public.

At Corundum hill, Macon County, N.C., about one hundred gems have been found during the last twenty years, some of good blue color and some of good red color, but none exceeding $100 in value, and none within the past ten years.

Of the beryl gems (emerald, aquamarine, and yellow beryl) the emerald has been mined to some extent at Stony Point, in Alexander County, N.C., and has also been obtained at two other places in the county. Nearly every thing found has come from the Emerald and Hiddenite mines, where during the past decade emeralds have been mined and cut into gems to the value of $1,000, and also sold as mineralogical specimens to the value of $3,000; lithia emerald, or hiddenite, to be cut into gems, $8,500, and for mineralogical specimens $1,500; rutile, cut and sold as gems, $150, and as specimens, $50; and beryl, cut and sold as gems, $50. At an altitute of 14,000 feet, on Mount Antero, Colorado, during the last three years, material has been found which has afforded $1,000 worth of cut beryls. At Stoneham, Me., about $1,500 worth of fine aquamarine has been found, which was cut into gems. At New Milford, Conn., a property was extensively worked from Oct., 1885, to May, 1886, for mica and beryl. The beryls were yellow, green, blue, and white in color, the former being sold under the name of "golden beryl." No work has been done at the mine since then. In 1886 and 1887 there were about four thousand stones cut and sold for some $15,000, the cutting of which cost about $3,000.

Turquoise, which was worked by the Aztecs before the advent of the Spaniards and since then by the Pueblo Indians, and largely used by them for ornament and as an article of exchange, is now systematically mined near Los Cerrillos, N. Mex. Its color is blue, and its hardness is fully equal to that of the Persian, or slightly greater, owing to impurities, but it lacks the softness of color belonging to the Persian turquoise. From time immemorial this material has been rudely mined by the Indians. Their method is to pour cold water on the rocks after previously heating them by fires built against them. This process generally deteriorates the color of the stone to some extent, tending to change it to a green. The Indians barter turquoise with the Navajo, Apache, Zuñi, San Felipe, and other New Mexican tribes for their baskets, blankets, silver ornaments, and ponies.

The finest garnets and nearly all the peridots found in the United States are obtained in the Navajo Nation, in the northwestern part of New Mexico and the north-eastern part of Arizona, where they are collected from ant-hills and scorpion nests by Indians and by the soldiers stationed at adjacent forts. Generally these gems are traded for stores to the Indians at Gallup, Fort Defiance, Fort Wingate, etc., who in turn send them to large cities in the east in parcels weighing from half an ounce to thirty or forty pounds each. These garnets, which are locally known as Arizona and New Mexico rubies, are the finest in the world, rivaling those from the Cape of Good Hope. Fine gems weighing from two to three carats each and upward when cut are not uncommon. The peridots found associated with garnets are generally four or five times as large, and from their pitted and irregular appearance have been called "Job's tears." They can be cut into gems weighing three or four carats each, but do not approach those from the Levant either in size or color.

Since the discovery of gold in California compact gold quartz has been extensively used in the manufacture of jewelry, at one time to the amount of $100,000 per annum. At present, however, the demand has so much decreased that only from five to ten thousand dollars' worth is annually used for this purpose. In addition to the minerals used for cabinet specimens, etc., there is a great demand for making clocks, inkstands, and other objects.

During the year 1887 about half a ton of rock crystal, in pieces

[1] From Census Bulletin No. 49, by George F. Kunz.

weighing from a few pounds up to one hundred pounds each, was found in decomposing granite in Chestnut Hill township, Ashe County, N.C. One mass of twenty and one-half pounds was absolutely pellucid, and more or less of the material was used for art purposes. This lot of crystal was valued at $1,000.

In Arkansas, especially in Garland and Montgomery Counties, rock crystals are found lining cavities of variable size, and in one instance thirty tons of crystals were found in a single cavity. These crystals are mined by the farmers in their spare time, and sold in the streets of Hot Springs, their value amounting to some $10,000 annually. Several thousand dollars' worth are cut from quartz into charms and faceted stones, although ten times that amount of paste or imitation diamonds are sold as Arkansas crystals.

Rose quartz is found in the granitic veins of Oxford County, Me., and in 1887, 1888, and 1889 probably $500 worth of this material was procured and worked into small spheres, dishes, charms, and other ornamental objects.

The well-known agatized and jasperized wood of Arizona is so much richer in color than that obtained from any other known locality that, since the problem of cutting and polishing the large sections used for table tops and other ornamental purposes was solved, fully $50,000 worth of the rough material has been gathered and over $100,000 worth of it has been cut and polished. This wood, which was a very prominent feature at the Paris Exposition, promises to become one of our richest ornamental materials.

Chlorastrolite in pebbles is principally found on the inside and outside shores of Rock Harbor, a harbor about eight miles in length on the east end of Isle Royale, Lake Superior, where they occur from the size of a pin head to, rarely, the size of a pigeon's egg. When larger than a pea they frequently are very poor in form or are hollow in fact, and unfit for cutting into gems. They are collected in a desultory manner, and are sold by jewelers of Duluth, Petoskey, and other cities, principally to visitors. The annual sale ranges from $200 to $1,000.

Thomsonite in pebbles occurs with the chlorastrolite at Isle Royale, but finer stones are found on the beach at Grand Marais, Cook County, Minn. Like the chlorastrolites, they result from the weathering of the amygdaloid rock, in which they occur as small nodules, and in the same manner are sold by jewelers in the cities bordering on Lake Superior to the extent of $200 to $1,000 worth annually.

In New York there are sixteen firms engaged in cutting and recutting diamonds, and in Massachussetts there are three. Cutting has also been carried on at times in Pennsylvania and Illinois, but has been discontinued. In 1889 seven of the New York firms ran on full time, but the others were unemployed, respectively, 14, 50, 61, 120, 125, and 240 days, owing to inability to obtain rough material at a price at which it could be advantageously cut. The firms that were fully employed were generally the larger ones, whose business consisted chiefly in repairing chipped or imperfectly cut stones, or in recutting stones previously cut abroad, which, owing to the superior workmanship in command here, could be recut at a profit, or in recutting very valuable diamonds when it was desired, with the certainty that the work could be done under their own supervision, thus guarding against any possible loss by exchange for inferior stones.

The industry employed 236 persons, of whom 69 were under age, who received $148,114 in wages. Of the nineteen establishments, sixteen used steam power. Foot power is used in only one establishment. Three of the firms are engaged in shaping black diamonds for mechanical purposes, for glass cutters and engravers, or in the manufacture of watch jewels.

Beginning in the latter part of 1888, and through 1889, there was a marked increase in the price of rough diamonds, resulting in rapid advances of from 20 to 25 per cent at a time, amounting in all to an advance of from 80 to 100 per cent above the prices of the previous years.

The importation of rough and uncut diamonds in 1880 amounted to $129,207, in 1889 to $250,187, and the total for the decade was $3,138,529, while in 1883 there were imported $448,-996 worth, showing that there was 94 per cent more cutting done in 1889 than in 1880, but markedly more in 1882 and 1883. This large increase of importation is due to the fact that in the years 1882 to 1885 a number of our jewelers opened diamond-cutting establishments, but the cutting has not been profitably carried on in this country on a scale large enough to justify branch houses in London, the great market for rough diamonds, where advantage can be taken of every fluctuation in the market and large parcels purchased, which can be cut immediately and converted into cash; for nothing is bought and sold on a closer margin than rough diamonds. There has been a remarkable increase in the importation of precious stones in this country in the last ten years. The imports from 1870 to 1879, inclusive, amounted to $26,698,203, whereas from 1880 to 1889, inclusive, the imports amounted to $87,198,110, more than three times as much as were imported the previous decade.

THE PENINSULA OF KAMTCHATKA.[1]

THOUGH this country passed in 1696 into the hands of the Russians, it is still one of the least known parts of their empire. Professor Umlauft gives its area as 104,200 square miles. It is traversed along its whole length by a mighty chain of mountains, which rise into the regions of eternal snow. On the eastern side are numerous volcanoes, of which twenty-one are now active. Dittmar's map (1850) shows only twelve active volcanoes, from which it may be inferred that the subterranean forces have developed a large amount of energy since his time. At the southern extremity of the peninsula numerous isolated volcanic cones rise from the low ground, of which the Apatcha only is active. To the north of this mountain the country begins to rise, and at length two chains are formed, of which the western extends through the whole peninsula. Only one volcano, the Icha, is situated actually within the range, but several others lie between it and the western coast. Below the 57th parallel the river Tigil has eroded a narrow valley through the range, and a little further north a deep depression interrupts the continuity, but the elevation soon increases again, and is continued in the Voyampolka Mountains. The eastern range is far shorter, extending only to the 55th parallel. It also contains only one volcano, but the short range which runs off from it in a south easterly direction to Cape Shipunskie contains several, among them the Koryaka, which attains a height of 11,218 feet. They are particularly numerous in the elevated country which adjoins the eastern range, and entirely fills the space between the middle and lower Kamtchatka River and the eastern coast. Here stands the Klutshef, the culminating summit of the peninsula, 15,757 feet high. On the left bank of the Kamtchatka the Timaska, a low chain with rounded summits, runs eastward, and is joined on the north by the Novikofskaia Vershina, ending in Cape Stolbovi. Beyond the 57th parallel northwards there is only the one range. Numerous hot springs testify to the volcanic character of the eastern part of Kamtchatka. Dittmar found the temperature of a spring near the Mikishina to be 120° F. on Dec. 16th, when the temperature of the air was −11°. Owing to the great atmospheric moisture and the abundant rainfall, the country is irrigated by numerous rivers, of which the Kamtchatka is the largest. The Shupanof, on the east, and the Bolshaya, Icha, and Tigil, on the west, are also important streams. The climate is changeable and severe, and much colder than that of countries in the same latitude on the other side of the Old World. When Dittmar visited the country, there was ice in May on an inlet of Avatcha Bay, and on the west coast, which is much colder, the thermometer stood at sunrise on Aug. 2d at about 34° F. In winter, temperatures of −40° and lower were recorded. The snow-line lies at a height of about 5,300 feet.

In Kamtchatka, as in central Siberia, the vegetation is surprisingly exuberant. Rich meadow-land alternates with dense woods, composed, in the south, of poplars, willows, and birches. Where the woods are thin, bushes grow freely, and flowering plants bedeck the ground. Wild animals are abundant, and hunting and fishing are the chief means of procuring food. The most important game are wild reindeer, wild sheep, hares, otters, sables, and ermine. Bears, wolves, and foxes are also numerous. Of birds, heathcock,

[1] From the Scottish Geographical Magazine, April, 1891.

swans, geese and ducks, and sea-fowl may be mentioned. In the southern rivers salmon is plentiful.

The southern part of the peninsula is inhabited by Kamtchadales, numbering some 4,000 souls. They have submitted to Russian influence, and are Christians in name, but still cling to the rites of Shamanism. Their mud huts have given place to houses, round which gardens are laid out. They keep cattle and a few horses and fowls, but neither sheep nor pigs. In the north about 8,000 Koriaks live, who are still in a primitive state, and subsist on the produce of the chase and fishing. Their most important domestic animals are dogs, which draw their sleighs.

THE MEAN COAST-DISTANCES OF CONTINENTS.

THE proximity of countries to the sea has a most important bearing on their climate, commercial development, etc., and therefore the problem of ascertaining the relative advantages in this respect of different parts of the world has long attracted the attention of geographers. In *Petermann's Mittheilungen*, Bd. 36, Nos. 3 and 4, Dr. Carl E. M. Rohrbach explains a new method of solving the problem, in which the mean distances of the continental lands from the coast play an important part. As quoted in the *Scottish Geographical Magazine*, he shows, as a preliminary investigation, that the mean distance of a circle from the circumference is one-third the radius, and that this distance is the same for a square, or other rectilinear figure, circumscribing the circle. It is found by integrating the product of an elementary area into its distance from the perimeter and dividing by the whole area. The process is, therefore, similar to that of finding the centre of gravity of the area, and, accordingly, the value may be very simply found by dividing the circle or square into indefinitely small triangles by radii drawn from the centre, the centres of gravity of which are, of course, at one-third of the radius from the perimeter. From this result Dr. Rohrbach deduces the mean distance for a rectangle, and shows how to find it for a *calotte*, or the spherical area contained by a small circle of a sphere. Even for a large *calotte* it differs very little from that of a circle of equal area. These investigations prove that of all figures containing the same area the circle and its circumscribed figures are those in which the distances from the perimeter are greatest, and this proposition is exhibited in a convenient form by means of curves, in which the abscissæ are proportional to the areas, and the ordinates to the distances from the perimeter. In the diagram thus constructed the curve (a parabola, of course) for the circle lies outside all the others, and as the area deviates more and more from the circular form, its curve approximates more closely to a straight line. Owing to this property the circle gives a convenient standard for mean distance from the coast, as will be seen presently.

In dealing with continental areas Dr. Rohrbach draws contour-lines on a map parallel to the coast-line at certain chosen intervals, and measures the areas contained with a planimeter. If great accuracy be desired, the lines must be traced on a map in which there is no distortion, and then transferred for measurement to an equal-area map, but in a first essay, to demonstrate the applicability of the method and the value of its results, Dr. Rohrbach considered Bonne's projection sufficiently accurate for tracing the lines as well as for measurement. A map of the world and another of Europe are appended to the article, on which the contour-lines are drawn, and the coast-distance of the areas between them denoted by different colors. The relative conditions of the continents are also shown, both by rectangles of which the bases are proportional to the areas, and the altitudes to the mean coast-distances, and also by curves — *chorigraphic*, as Dr. Rohrbach calls them — where the ordinates represent the coast-distances corresponding to the areas indicated by the abscissæ. Tables are given showing the areas lying beyond different distances from the coast in the various continents, both in square kilometres and in percentages. The following shows the mean coast-distances: Europe, 208 miles; Asia, 482 miles; Eurasia, 433 miles; Africa, 417 miles; Australia, 214 miles; North America, 292 miles; South America, 343 miles; the five continents, 381 miles.

As a measure of the accessibility of continents from the coast, Dr. Rohrbach proposes the quotient obtained by dividing the mean distance in a circle, or in a *calotte*, of equal area by the actual mean distance, and gives the numbers in the latter case, but the result is scarcely satisfactory. As he himself points out, Eurasia appears to greater advantage than Europe, because the mean distance in the *calotte* is calculated as though sea instead of land lay to the east, and thus the quotient is increased. It is also startling to find North America represented by a higher figure than Europe, and the five continents by a number more than twice as great. It is easy to see that these discrepancies arise because the numbers represent only the advantage each continent derives from its actual shape compared with its accessibility if formed into a *calotte*, and do not indicate the relative accessibility of the continents. A more correct idea is obtained by taking the mean coast-distance (1,416 miles) in a *calotte* of area equal to that of the five continents, or the actual mean distance (381 miles), as unity. In the latter case the numbers are as follows: Europe, 1.83; Asia, 0.79; Eurasia, 0.88; Africa, 0.91; Australia, 1.78; North America, 1.30; South America, 1.11; the five continents, 1.00.

Dr. Rohrbach claims that his method is superior to those before employed, because the mean coast-distance is a quantity admitting of simple definition, and not deduced by any artificial means from the geometrical forms. Its value also is easily reckoned, and can be worked out to any desired degree of accuracy, maps of various scales being employed according to the extent and configuration of the countries under examination. In almost all other methods the length of the coast-line has been used, the estimation of which leaves much room for speculation, causing great uncertainty in the results. In the present method this quantity is not needed, and yet the meanderings of the coast-line exercise their due influence on the curvature of the contour-lines, as may be clearly seen on the map of Europe already alluded to. And not only is the method applicable to purely morphological investigations, but charts may also be constructed, showing the relative conditions of the various parts of a country with regard to means of communication. Thus, an ice-bound coast may be treated as an inland boundary, and, where a chain of mountains intervenes, the contour-lines may be drawn so that their normals run to the sea past the extremities of the chain, or converge to the passes. Navigable rivers, railways, etc., may also be taken into account, and also the elevation, etc., charts being constructed to show the work required to transport a unit weight of goods, say a hundred-weight, from the coast. Each contour-line in such charts will pass through all places to which the labor of transport is the same, and will therefore resemble an isobar or isotherm.

BOOK-REVIEWS.

Grammatica elementar do Kimbundu. Kimbundu Grammar. Por HELI CHATELAIN. Genebra, 1889.

La Lengua Cunza. Por FRANCISCO DE SAN-ROMAN. Santiago de Chile, 1890.

Kreolische Studien. Ueber das Malaisportugiesische von Batavia und Tugu. Von HUGO SCHUCHARDT. Vienna, 1891.

Etudes de Grammaire Comparée. De la Categorie des Modes. Par RAOUL DE LA GRASSERIE. Louvain, 1891.

THIS batch of recent linguistic works, in widely diverse fields, is but a faint indication of the activity in this branch of scientific research.

Mr. Chatelain has been connected with the American mission in south-west Africa, and his grammar of the Kimbundu, a member of the wide-spread Bantu group, has particular interest, not only for its practical value in missionary work, but because the Smithsonian Institution is about to publish the author's collections of folk tales and legends in the original tongue, together with translations and notes.

The Cunza language is spoken by a native tribe on the south-west coast of South America, at the northern border of the Desert of Atacama. It is supposed by the eminent linquist von Tschudi to be the ancient Calchaqui. Although San Roman does not furnish a full grammatical view of the tongue, we are glad to have even his incomplete notes, as heretofore there has been absolutely nothing on its grammatic structure.

Professor Hugo Schuchardt is the most distinguished student living of mixed languages or "jargons," and his researches into their structure have been prolific of valuable results. The above is but one — the ninth — of his numerous "Creole Studies." It is one of the most instructive, as exhibiting the results of the commingling of the Portuguese with the Malayan languages, which are particularly widely apart. Like all his essays, it is replete with erudition, and marked by soundness and caution in handling facts.

The logical processes underlying language in general have been analyzed in a number of essays by Dr. Raoul de la Grasserie in his "Studies in Comparative Grammar." He has taken up in turn such topics as "the substantive verb," "pronouns," "tenses," etc., and striven to show by a very wide induction how these fundamental grammatical notions arose in the mind, and in what varied forms they sought expression in speech. The study above referred to, on "the category of moods" extends these comparisons to that feature of the verb. It is a masterly application of the principles of psychology to the evolution of language.

The Elements of Dynamic Electricity and Magnetism. By PHILIP ATKINSON. New York, Van Nostrand. 405 p. 8°.

As this is intended more for learners than for the learned, it appeals to a larger circle than do many other works on the subjects treated, and, for the same reason, mathematical formulæ are conspicuous by their absence. Mathematical reasoning, where required, has been, so far as possible, rendered intelligible to non-mathematical readers by the use of ordinary language and some unavoidable circumlocution, so that the amount of mathematical formulæ required has been practically reduced to a few simple expressions easily understood by persons familiar with arithmetic.

The work is divided into thirteen chapters, each of which is intended to be a complete treatise on the subject to which it relates, and the whole to embrace all the essential facts pertaining to dynamic electricity.

The chronological order of electrical development has been followed pretty closely, thus not only giving a condensed history of the progress made in the science, but also showing the relations of each successive important invention to those which preceded and followed it. The style of the work is as clear as a due regard for the conciseness necessary in such a treatise will admit.

The different parts of the subject are taken up in the following order, a chapter being devoted to each. The voltaic battery, with definitions of the terms used; one-fluid cells; two-fluid cells, and battery formation; magnetism; electromagnetism; electric measurement; the dynamo and motor; electrolysis; electric storage; the relations of electricity to heat; the relations of electricity to light; the electric telegraph; and the telephone.

Prussian Schools through American Eyes. By JAMES RUSSELL PARSONS, JR. Syracuse. Bardeen. 8° $1.

THE author of this book was recently United States Consul at Aix-la-Chapelle, and was employed by the authorities of the State of New York to make a report on the organization and methods of the Prussian schools, with a view to obtaining hints from them for the improvement of our own. Having been a school commissioner in New York State for some years, and being greatly interested in the public schools, Mr. Parsons took up the task assigned him with ardor and intelligence, and now gives us in this volume the result of his inquiries. The report is drawn up in the usual style of public documents, with little pretence of literary form, so that it is not so attractive to the reader as it might otherwise have been; but it presents a large amount of information concerning the Prussian schools in a form convenient for reference. It treats of the organization and government of the schools, the methods of discipline and of teaching, with some account of the buildings and apparatus, and gives a very full exposition of the courses of study. The normal schools are also dwelt upon at considerable length, and the mode of training teachers described.

Mr. Parsons is an admirer of the Prussian system, which he declares to be the best in the world; yet he sees that there is much in it which our people, accustomed to greater freedom and not readily submissive to government drill, would not be willing to adopt. Two of the main points of superiority in the Prussian schools, as compared with those of New York, are, in his view, the compulsory education law, which is rigidly enforced, and the official courses of study for the various schools, which insure a higher average grade of instruction than is usual in New York. Mr. Parsons also calls attention to the fact that school commissioners in Prussia must be properly trained for their work, and must have served for a time as teachers before being appointed to the higher office; whereas in this country the main qualification of such officers is the ability to secure a majority of the votes in a popular election. These are, in his opinion, the points in which we might most advantageously imitate the Prussian system; but he also notices a few others, while in some respects he shows that our own schools are superior. The report may be heartily recommended to all who are interested in the subject.

AMONG THE PUBLISHERS.

PHOTOGRAPHIC amateurs will read with interest Ellerslie Wallace's paper on "Photographic Dark Rooms," in *Outing* for May.

— The *Home Journal* devotes an entire page of its issue of May 6 to what may be called a guide to London hotels, though the formality of a "Guide" is avoided, and the information is put in a style which renders it entertaining even to the stay-at-home tourist.

— The May 2 issue of *The Medical and Surgical Reporter*, Philadelphia, is the first to appear under the new editor, Edward T. Reichert, M.D. The paper has been enlarged from twenty-eight to forty pages.

— William Cushing, 19 Ware Street, Cambridge, Mass., has been employed during the last year in collecting brief biographical notices of Harvard graduates, which he hopes soon to publish under the title "Harvard Graduates Before 1860."

— John Wiley & Sons have in preparation a work on "Car Lubrication," by W. E. Hall of the Pennsylvania Railroad; "The Mechanical Engineer's Pocket-Book," by William Kent, M.E.; also "The Transitive Curve Field Book," by Clinton R. Howard, C.E.

— The Salem Press Publishing and Printing Company, Salem, Mass., will publish in June, "Salem Witchcraft in Outline," by Caroline E. Upham, a niece of Dr. O. W. Holmes. In August they will publish "Historic Storms," by Sidney Perley; an interesting account of the great storms, cold winters, hot summers, etc., from 1620 to the present.

— Ginn & Co. have just published "Business Book-Keeping," a manual of modern methods in recording business transactions by single entry. George E. Gay of the High School, Malden, Mass., is the author. The forms given in the book are taken from the methods of the best accountants, are well adapted to their purpose, and are presented in a manner that appears to be both practical and satisfactory.

— *Babyhood* for May contains an article on "Chronic Throat Troubles Resulting from Diphtheria and Scarlet Fever, and How to Prevent Them," by Dr. D. Bryson Delavan, which lays stress on the fact, not generally known, that a considerable proportion of catarrhal diseases of the throat and nose have their origin in one of the above complaints. Many other medical topics of interest to mothers are discussed under "Nursery Problems."

— We have received from C. W. Bardeen of Syracuse a small volume entitled "Apperception," which is intended more especially for teachers. It should have been entitled "Perception," for that is the subject of the book, and indeed the barbarous term "apperception" is nowhere used except upon the title-page. The main purpose of the author is to call attention to the fact that the perception of outward things is largely a matter of interpretation, every new object requiring to be classified and assigned its proper place in the general system of our knowledge. There is nothing new or striking in the book, but it may be suggestive to teachers

who have not been in the habit of attending to this aspect of our mental operations.

— Of the two numbers of the *American Journal of Psychology* recently issued, one completes the third, and the other begins the fourth, volume of that magazine. The first contains an interesting article on the attitudes of the insane ("Automatic Muscular Movements of the Insane," by Dr. Charles P. Bancroft, superintendent of the New Hampshire asylum), illustrated with a plate showing some typical ones. Mr. Herbert Nichols contributes the historical part of a continued article on the "Psychology of Time," and Dr. C. F. Hodge one on the "Recovery of Ganglion Cells after Electrical Stimulation." Besides the usual reviews and abstracts upon psychological literature ("Nervous System," Dr. H. H. Donaldson; "General Paralysis," Dr. Wm. Noyes; "Experimental"), the number contains a long and vigorous critique, by the editor, of Professor James's "Psychology." With this number is furnished also a complete index to authors of papers received, and a carefully made subject-index to the large amount of matter gathered in the review department. With the first number of the new volume, a change in the title-page and publisher (now J. H. Orpha, Clark University, Worcester, Mass.) has been made. The first article, by Dr. E. W. Scripture, is a very readable account of the arithmetical prodigies that have from time to time astonished the world of less ready reckoners, and of the methods by which their feats have been performed. The other leading article is a continuation from the previous number of Mr. Herbert Nichols's study of the psychology of time. The author first presents the results of his own long course of experimentation, a special phase of this difficult subject, and then makes exposition of an extremely plausible theory of his own with reference to how time is perceived and apperceived. The place of the usual reviews and abstracts is this time taken by four minor contributions, one upon "Cerebral Localization," by Dr H. H. Donaldson, being a report of six lectures on cerebral localization delivered before the Boston Medico-Psychological Society in February and March of this year, and giving in convenient shape, and sifted of unnecessary detail, a summary of recent anatomical contributions to this important subject. Another is upon "Brain Models," and by the same author. The third is the first installment of a laboratory course in physiological psychology, by Dr. E. C. Sanford, in substance a course given in Clark University. The fourth article is the first of a series upon contemporary psychologists, by the editor, this time upon Zeller, and deals largely with his contributions to the psychology of religion. We are confidently assured that there is no thought of permanently displacing the reviews.

— The May number of the *Atlantic Monthly* contains a number of articles of interest to teachers. Chief among these is a paper by Professor Truman Henry Safford of Williams College, on the "Modern Teaching of Arithmetic." The author traces the teaching of arithmetic from the time of the Greeks and Romans to our own day, shows the great influence of Warren Colburn and his "First Lessons," and ends his paper with a long account of the Grube method and its adaptability to the present times and methods of instruction.

— The March number of the publications of the American Statistical Association contains "The Growth of Cities in Massachusetts," by Hon. Horace G. Wadlin; "Rate of Natural Increase of Population in United States," by Herman Hollerith; "The First Census of Massachusetts," by Hon. Samuel A. Green; "The Commercial Death Rate," by Albert C. Stevens; "Parliamentary Elections in Japan," by Theodore M. MacNair; Reviews and Notices: Reports of Bureaus of Labor Statistics; Notes on President Walker's Article on Statistics of the Colored Race; The Birth Rate in Europe during the Last Twenty Years; United States Census Bulletins; Reports of State Boards of Charities and Corrections; Health and Vital Statistics; Statistical Year-Book of Uruguay; Report of the Comptroller of the Currency; Municipal Finance, Price Statistics; Minor Notices.

— The May issue of *Psyche, a Journal of Entomology*, contains "A List of the Orthoptera of Illinois, — IV." (concluded), by Jerome McNeill; "A Supplementary Note on Diabrotica, 12-punctata," by H. Garman; "Descriptions of the Preparatory Stages of Two Forms of *Cerura Cinerea* Walk.," by Harrison G. Dyar; "Two New Tachinids," by C. H. Tyler Townsend; "Edwards's Butterflies of North America;" "Packard's Forest-insects;" Personal Notes; and Proceedings of the Cambridge Entomological Club.

— Houghton, Mifflin, & Co. will publish immediately Mr. Fiske's work on the "American Revolution," in two volumes.

— T. Y. Crowell & Co. have just ready the third volume of Sybel's work on "The Founding of the German Empire." This volume is almost wholly occupied with events that occurred between 1848, when King Christian of Denmark died, and 1864, when the preliminaries of peace between Denmark and Germany were signed.

— G. P. Putnam's Sons have just ready, in the Questions of the Day Series, "The Question of Copyright;" the second edition, thoroughly revised and extended, of W. Swan Sonnenschein's "The Best Books," a list of the best available books in every department of literature; and a sketch of the life of Charles Darwin in the Leaders of Science Series.

— D. Appleton & Co. announce for early publication Baldwin's "Applied Psychology and Art of Teaching;" Herbart's "Psychology;" "A Descriptive Guide-Book to Canada," including accounts of the opportunities for sportsmen and tourists, by Charles G. D. Roberts; new editions of Appleton's "Dictionary of New York," "Summer Resorts," and "General Guide to the United States and Canada;" and "North America," Vol. XV. of Reclus's great work, "The Earth and Its Inhabitants."

— Hypnotism, which is now attracting such widespread attention, is considered in No. 3 of the Fowler & Wells Library, under the title of "How to Magnetize; or, Mesmerism and Clairvoyance, a Practical Treatise on the Choice, Management, and Capabilities of Subjects, with Instructions on the Manner of Procedure," by James Victor Wilson. The work closes with a chapter on animal magnetism as a therapeutic means, written by Dr. Fleming.

— The fifth volume of the Century Dictionary has just been issued. The fourth was issued six months ago, and it is expected to complete the book by the publication of the sixth and last volume in the autumn. The present volume brings the work down to Stro-, the words defined numbering now about 185,000. This number is the more surprising when it is considered that no effort has been made to swell the total, but, on the contrary, careful selection has constantly been exercised. It would have been easy, by the admission of self-explaining derivates, and of "new words" from unauthoritative (unscientific and unliterary) sources, to have increased the list by many thousands. In the above enumeration transitive and intransitive uses of the same verb, and substantive and adjective uses of the same word, are counted but once (being entered under one head in the dictionary) instead of twice as in the older dictionaries (where they are entered separately as different "words"). The fifth volume is more distinctively literary in character than those that preceded it, owing to the greater proportion of literary words in *R* and *S*. It contains, however, many important scientific terms, as spectrum, spectroscope, Saturn, etc., and a glance at the pages will show many unusually interesting definitions, as under ship, rifle, shoe, relation, relief, run, rack, safe, star, steam-engine, stand, etc., with hundreds of exquisite engravings of art-objects. The bulk of the volume consists of the letter *S*, which (as far as Stro-) occupies 716 pages, with about 21,500 words. The entire letter will occupy 860 pages, being the largest in the dictionary.

— "Crustacea from the northern coast of Yucatan, the harbor of Vera Cruz, the west coast of Florida, and the Bermuda Islands," is the title of a paper by J. E. Ives, in the Proceedings of the Academy of Natural Sciences, Philadelphia, March 31. The crustacea treated of in this paper were collected for the greater part on the northern coast of Yucatan and in the harbor of Vera Cruz, during the early months of 1890, by the expedition in charge of Professor Angelo Heilprin, sent by the Academy of Natural Sci-

ences of Philadelphia to investigate the natural history of Yucatan and Mexico. The paper also includes a list of the crustacea collected upon the west coast of Florida in the spring of 1886 by Professor Heilprin and Mr. Joseph Willcox, under the auspices of the Wagner Free Institute of Science of Philadelphia, and the description of a new Isopod, collected by the Academy's expedition to the Bermuda Islands in 1888. It is remarkable that the shores of Yucatan and Mexico, portions of the American continent among the first to be discovered by Europeans, should be among the last to have their zoölogy investigated. Nothing whatever, with one or two isolated exceptions, has been known hitherto of the fauna of the shores of Yucatan, and very little of that of the eastern coast of Mexico. The material collected by the expedition has added considerably to the knowledge of this region.

— The late Richard A. Proctor, according to *Literary News*, was gifted with a remarkable memory. Thackeray was his favorite novelist, and he could repeat verbatim page after page of "The Newcomes;" so much in fact that the dear old Colonel became an unmitigated bore to his former friends.

— The officers for 1891–92 of the Boston Society of Natural History will be: president, George L. Goodale; vice presidents, William H. Niles, B. Joy Jeffries, Samuel Wells; curator, Alpheus Hyatt; secretary, Samuel Dexter; treasurer, Charles W. Scudder; librarian, Samuel Dexter.

— The Fiske range-finder, which was first described in these columns last year, has been very favorably received by the naval departments of several different countries, the remarkable results obtained by the exhaustive trials carried out on board United States war-ships having given a sufficient guarantee of the practical value of the instrument. In the American navy the range-finder was installed on board the "Baltimore," and from the extensive trials made with it there, during six months at sea, the writers of the official report state that it is accurate within three per cent on ranges up to 5,000 yards. In France, according to *Engineering*, the range finder has been mounted on board "Le Formidable," the flagship of the French Mediterranean fleet, and extensive trials were made in February last with the instrument to determine the distance between vessels having a relative motion of from 0 to 28 knots. Under these conditions the results were found to be accurate within five per cent. From experiments on fixed objects the commission in charge report that the instrument could be used by trained observers under the conditions of combat, and they remark that a specially valuable feature of the instrument is that it enables the observer to record the distance — to within a very small percentage — between forts or ships, before firing grows heavy. Difficulty in observation would, of course, be increased in a heavy seaway, but not so much as would the accurate pointing of the guns, so that the range-finder can be always relied on to give more accurate work than the guns. The com-

Publications received at Editor's Office, April 27–May 2.

AMMEN, D. The Old Navy and the New. Philadelphia, Lippincott. 553 p. 8°. $3.
BROOKS, W. K. The Oyster. Baltimore, Johns Hopkins Press. 230 p. 12°.
D'ANVERS, N. The Story of Early Man (2d ed.). New York, Whittaker. 140 p. 12°. 40 cts.
D'ANVERS, N. The Life Story of Our Earth (2d ed.). New York. Whittaker. 165 p. 12°. 40 cts.
FINE, H. B. The Number-System of Algebra. Boston and New York, Leach, Shewell, & Sanborn. 181 p. 12°. $1.
JONES, D. E. Elementary Lessons in Heat, Light, and Sound. London and New York, Macmillan. 280 p. 12°. 70 cts.
KEEP, R. P. The Essential Uses of the Moods in Greek and Latin, Set Forth in Parallel Arrangement. Boston, Ginn. 56 p. 16°.
NEW YORK, Fifth Annual Report of the Factory Inspectors of the State of. Albany, State. 678 p. 8°.
OTT, I. The Modern Antipyretics: Their Action in Health and Disease. Easton, Pa., Vogel. 52 p. 8°.
OUR LANGUAGE. Vol. I., No. 1. April, 1891. New York, F. A. Fernald. 8 p. 4°. *m.* 50 cts. per year.
PARSONS, J. R., Jr. Prussian Schools through American Eyes. Syracuse, Bardeen. 91 p. 8°. $1.
ROOPER, T. G. Apperception; or, The Essential Mental Operation in the Act of Learning. Syracuse, Bardeen. 52 p. 12°. 50 cts.
TRELEASE, W. The Species of Epilobium Occurring North of Mexico. St. Louis, Nixon-Jones Co. Pr. 117 p. 48 pl. 8°.
VON MEYER, E. A History of Chemistry from Earliest Times to the Present Day. London and New York, Macmillan. 556 p. 8°. $4.50.
WINCHELL, N. H. & H. V. Iron Ores of Minnesota (Bulletin No. 6, Geol. and Nat. Hist. Survey of Minnesota). 480 p. 8°. Geol. Map and 44 pl.

mission consider the instrument will be particularly useful at night, as the mere flash of a gun will be sufficient to give the range of the vessel firing it. Even more satisfactory experiments were made on board "Il Terribile," of the Italian navy at Spezzia last month, when it was found that, with the ship moving, the distance of a moving target was ascertained with an error of only 1.8 per cent per 1,000 metres range.

— A series of experiments in treating corn with various substances to prevent its being taken by the striped squirrels was carried on at the Iowa Experiment Station last spring. The corn was treated in the following manner: Smoked with meat in an ordinary smoke-house until the kernels were black; smoked in a barrel with tobacco dust; smoked over night in strong decoctions of tobacco and of quassia chips; soaked in a dilute carbolic-acid mixture, in strong alum water, in salt water, and kerosene. The squirrels would take the corn treated in any of these ways, though the carbolic-acid treatment and the smoking with tobacco made the corn distasteful, and when in the vicinity of other grain would be left till the last. The best remedy seems to be to harrow the ground immediately after planting to cover the planter tracks, and then to scatter corn about the border of the fields and in the vicinity of the squirrel holes as soon as the corn begins to come up.

— "Schliemann was thirty-four years old," says the Chicago *Tribune*, "before he knew a word of Greek, and it was not until he was forty-one that he began the study of archæology, in which he was destined to achieve so much distinction. By the way, there was an interesting clause inserted in the marriage contract between the late Dr. Schliemann and the Greek girl whom he made his second wife, to the effect that she should improve her knowledge of Homer by learning and reciting fifty lines of the Iliad nightly. Schliemann, when telling the story to his friends, always said that neither tears nor entreaties ever induced him to let her off a single line."

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Aspect of the Heavens—April, 1891.
A Protest against Indiscriminate Collecting.
Color Photography.
Mason's Improved Oxy-hydrogen Lantern and Table Microscope.
Science Jottings.
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  Cuba breaking in Two.
  Grafting Human Skin.
  Limit of Magnification for Photo-Micrography.
  Death of Dr. Brady, F.R.S.
  Condenser for the Microscope.
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PSYCHE.

A Journal of Entomology, published monthly by the Cambridge Entomological Club. $2.00 per year, $5.00 per volume of three years. Volume VI. began in January, 1891. Back volumes for sale at $5.00 each. Volume I. sold *only* in complete sets.

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8°, about 400 pp., $3.50.

FOSSIL RESINS.

By CLARENCE LOWN and HENRY BOOTH.

This book is the result of an attempt to collect the scattered notices of fossil resins, exclusive of those on amber. The work is of interest also on account of descriptions given of the insects found embedded in these long-preserved exudations from early vegetation.

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"His book is an excellent one, and we can heartily recommend it as an introductory manual of ethnology."—*The Monist.*

"A useful and really interesting work, which deserves to be widely read and studied both in Europe and America."—*Brighton* (Eng.) *Herald.*

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"Dr. Brinton invests his scientific illustrations and measurements with an indescribable charm of narration, so that 'Races and Peoples,' avowedly a record of discovered facts, is in reality a strong stimulant to the imagination."—Philadelphia *Public Ledger.*

"The work is indispensable to the student who requires an intelligent guide to a course of ethnographic reading."—*Philadelphia Times.*

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THE MODERN MALADY; or, Sufferers from 'Nerves.'

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"All interested in biological questions will find the book fascinating."—*Pharmaceutical Era.*

"The author displays a very comprehensive grasp of his subject."—*Public Opinion.*

"Deserves the attention of students of natural science."—*Critic.*

IV. THE CHEROKEES IN PRE-COLUMBIAN TIMES. By CYRUS THOMAS. 12°. $1.

Dr. Thomas has already presented to the public some reasons for believing the Cherokees were mound-builders, but additional evidence bearing on the subject has been obtained. A more careful study of the Delaware tradition respecting the Tallegwi satisfies him that we have in the Bark Record (Walam Olum) itself proof that they were Cherokees. He thinks the mounds enable us to trace back their line of migration even beyond their residence in Ohio to the western bank of the Mississippi. The object is therefore threefold: 1. An illustration of the reverse method of dealing with prehistoric subjects; 2. Incidental proof that some of the Indians were mound-builders; 3. A study of a single tribe in the light of the mound testimony. This work will be an important contribution to the literature of the Columbian discovery which will doubtless appear during the coming two years.

"A valuable contribution to the question, 'Who were the mound-builders?'"—*New York Times.*

"Professor Cyrus Thomas undertakes to trace back the evidences of a single Indian tribe into the prehistoric or mound-building age."—*N. Y. Sun.*

"An interesting paper."—*Christian Union.*

V. THE TORNADO. By H. A. HAZEN. 12°. $1.

"The little book is extremely interesting."—*Boston Transcript.*

"A book which will find many readers. The chapter on 'Tornado Insurance' is of interest to all property-holders in the tornado States."—*Boston Herald.*

"'The Tornado' is a popular treatise on an important province of meteorology, in which science, the author, Professor Hazen of the United States Signal Service, may be regarded as an expert."—*Philadelphia Ledger.*

VI. TIME-RELATIONS OF MENTAL PHENOMENA. By JOSEPH JASTROW. 12°. 50c.

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VII. HOUSEHOLD HYGIENE. By MARY TAYLOR BISSELL. 12°. 75 cents.

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In Preparation.

VIII. THE FIRST YEAR OF CHILDHOOD. By J. MARK BALDWIN.

N. D. C. HODGES, 47 Lafayette Place, New York.

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SCIENCE

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"The main point which I would urge upon your [redacted]ving the electrical energy something which experience shows it will readily dissipate, that is, a conductor of varying resistance and small size, we can but mitigate the effects of lightning-discharges, so long as the conservation of energy holds true. I will only repeat that I have so far found no case on record where the dissipation of such a conductor has failed to protect the building under the conditions already explained."—*From paper read before the American Institute of Electrical Engineers, April 21.*

PRESS COMMENTS:

"If the theory advanced by Mr. N. D. C. Hodges, as to the cause of the damage and destruction of buildings when struck by lightning, and the method proposed to avert such damage is correct, that gentleman's discovery will properly rank as one of the most scientific and useful in the history of electricity. His reasoning seems to be correct, and it will be interesting to note the result of a practical test of his system of protecting buildings from damage by lightning. If he is right, then there will be no excuse for allowing property to go unprotected from lightning's destructive power. It is well to be prepared at all times for the unexpected, and lightning certainly possesses, more than anything else that we know of, a good deal of the element of uncertainty. It may, or may not strike one's property, and very frequently the lightning rods in vogue at the present time are no better than none at all. A reliable method of protection against damage to property by lightning is something very much desired, and if Mr. Hodges has discovered a means of accomplishing this result, his name will become intimately linked with that of the immortal Ben Franklin."—*Electrical Age, May 2.*

"The paper by Mr. N. D. C. Hodges, printed in this issue, on his new system of protection against lightning, adds some details to the description we gave of his ideas and methods two or three months ago. Mr. Hodges, having noticed that certain conditions and results attend a lightning stroke, has come to the conclusion that what is wanted is a protector that will dissipate the charge by means of its own dissipation. Such apparatus as he proposes would evidently be cheap, and there should be no difficulty in finding out whether the Hodges device is a protector that protects."—*Electrical Engineer, May 6.*

"As we understand it, the rod will consist of appropriately sized wire-pieces—which are to be fused or volatilized by the passage of the lightning; the energy being thus harmlessly converted. Undoubtedly there is room for improvement in the form of protector, conductor or discharger (or by whatever name we may call it) to be used in dealing with discharges of such high potentials as exist in lightning flashes. The really important part of this new invention is, that in its theory, it emphasizes the fact that the seat of the electrical energy is, and must be—not in the cloud or in the earth, just preceding a flash of lightning, but in the air column between cloud and earth."—*American Meteorological Journal, April.*

PROSPECTUS.

47 LAFAYETTE PLACE, NEW YORK, March 9, 1891.

It is proposed by the owners of letters patent dated Dec. 16, 1890, on an improved method for protecting buildings from lightning, etc., to organize a company for the handling of said patent and all improvements; and subscriptions are requested on the following terms and conditions:—

1. A company is to be organized with a capitalization of $10,000, in 1,000 shares of $10 each, fully paid in at par, the company to be organized in such State as the subscribers may determine by vote when all shares have been subscribed for, and with a charter to contain a provision that the amount of capitalization shall never be increased.
2. This $10,000 is to be used as working capital; and the object of the company will simply be to place licenses with responsible persons, corporations, or sub-companies, al such rates of royalty as may be agreed upon by a majority vote.
3. In lieu of any stock or cash payment to the inventor for his patent, the inventor will give said company the exclusive control of his said inventions in consideration of the payment to him by said company of one-third of the gross royalty receipts.

The officers of the company shall be elected by a majority vote of the stockholders without reserve. No stock shall be given to anybody for services or any thing else except actual cash payment at par into the treasury.

No subscriptions will be binding until the full number of 1,000 shares has been subscribed for.

Subscriptions are solicited in amounts from five shares upwards. The list opens with subscriptions for **one hundred and twenty-five** shares.

The names of those who have subscribed will be sent to any intending subscriber upon application.

N. D. C. HODGES.

CALENDAR OF SOCIETIES.

New York Academy of Sciences.

May 18.—Charles F. Cox, What is a Diatom (illustrated by lantern views).

Appalachian Mountain Club, Boston.

May 18.—Henry G. Spaulding, Landscape in Literature, Nature, and Art (Illustrated).

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

A GRADUATE of Yale College, now a medical student, who has made a specialty of the sciences, wishes employment during the summer vacation, from June 15th, to Oct. 1st, GEO. N. LAWSON, 22 College St., New Haven, Conn.

WANTED.—A permanent position that will pay $15 per week with prospect of advancement, by a young man (28) and college graduate of one year's experience. Address J. S. M., care of SCIENCE, 47 Lafayette Place, New York City.

WANTED.—Vols. I and II. of Allen's "Commercial Organic Analysis." SCIENCE BOOK AGENCY, 47 Lafayette Place, New York.

THERE is an opening in this office for a college graduate with scientific tastes. *Science*, 47 Lafayette Place, New York.

WANTED—A situation in an Analytical Laboratory during the summer vacation. Can give good references. Address M. ADGATE, North College, Burlington, Vt.

WANTED—A position in some College, Normal School or Academy to teach Biology, Physiology, Comparative Anatomy, Histology, Embryology or Botany. A graduate of the University of Wisconsin. Have had four years' experience as a teacher. Address "BIOLOGIST," care SCIENCE.

WANTED.—All of Vol. I. of *Journal of Analytical Chemistry*, published at Easton, Penn. State price and condition. SCIENCE BOOK AGENCY, 47 Lafayette Place, New York.

WANTED—A position in a Summer School of Gymnastics to teach any one or more of the following named physical exercises, viz.: Fencing (to ladies especially), Sparring, Club Swinging, Wands, Chest Weights and Free Movements. Am prepared to offer very favorable terms to any school desiring such work. WILLIAM FINDLAY, Proprietor of Phila. Inst. of Phys. Cult., 1009 Arch Street, Philadelphia, Pa.

A CHEMIST, taking P. G. work in the Scientific Department of one of our best colleges, would like to negotiate for some industrial position, where his knowledge would be of avail. Can furnish best of references. R. S. W., Box 691, Amherst, Mass.

WANTED—A position to teach Electrical Engineering by a student from leading English and French and U. S. science schools, or would accept position as Consulting Electrical Engineer, Electrician, etc. Very highest testimonials. London & Hartford Publishing Co., N. Y. (International Press Department.)

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

For sale, or exchange for geological works, the following works in anatomy, all latest editions: Allan, Tuain, Gray, Leidy, Massey, and Rollestin's Forms of Animal Life. S. W. Williston, Lawrence, Kan.

Will exchange a new Thomson reflecting astatic galvanometer, about 6,000 ohms, made by Clark, Muirhead & Co., London, and costing £30, with 1-9, 1-99, 1-999, shunts, lamp and scale, for a Weston voltmeter and ammeter, or arge Wheatstone bridge, dial pattern, or a portable testing outfit. Address G. A., *Science* Office, 47 Lafayette Place, New York.

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

SCIENCE

NEW YORK, MAY 15, 1891.

SOME POSSIBLE MODIFICATIONS IN THE METHODS OF PROTECTING BUILDINGS FROM LIGHTNING. — DISCUSSION.[1]

[Continued from p. 255.]

MR. EDWARD P. THOMPSON: — I have listened with a great deal of interest to the matter presented in the paper just read. The alleged facts seem to agree with our ideas of electricity of low potential. Electricity occurs in thunderstorms, and the best thing to do is to get rid of it. One way is by conducting it away sufficiently rapidly by means of a conductor of very large surface capacity, as the conductivity of a metal as to static electricity depends upon the surface and not upon the sectional area. This principle is applied in the ordinary lightning-rod. As I understand the speaker, he proposes to provide a system whereby the electrical energy is not conducted away, but converted into heat. In view of the conduction principle having so often proved a failure, and the conversion principle having succeeded every time, according to the researches of the speaker, and since his theory agrees with well-known electrical principles, I think Mr. Hodges has presented matter well worthy of the consideration of the institute, and I, for one, can find no objection to his system as to correctness of principle. As to practical equipment, some incombustible non-conductor, such as asbestos, should be placed between the thin metallic strip and the structure to be protected, or else the melted metal may set fire to the building.

Dr. William E. Geyer: — It seems to me that the occurrence quoted here from Franklin tends to show that the ordinary theory of the lightning-rod is essentially true. The bell-wire, so far as it went in the occurrence here described, was a lightning-rod, and protected the building so far as that lightning-rod went. It was not heavy enough to carry the current, and it was for that reason dissipated, so that the dissipation was simply an accident. The mere dissipation, however, did not save that part of the building where the wire stopped and there was no good conductor: the building was without any lightning-rod, and was more damaged than where it had even a small rod.

Mr. Townsend Wolcott: — Professor Lodge's theory of the Leyden-jar discharge is that it is oscillatory under ordinary conditions, that is, where the coatings are connected with a good conductor. Now, if they are connected with a bad conductor, such as a wet string, Professor Lodge says that the discharge may be only in one direction, that is, the energy is all dissipated in a single discharge; whereas, if the conductor is good, there is little energy dissipated in getting from one coating to another. So far, Mr. Hodges' theory would seem to agree with Professor Lodge's, that if you can use up the energy of the electricity in destroying the conductor you will get rid of it more quickly than you would in any other way, and the lightning will have less effect outside of that. But there are some other points. Mr. Hodges says we do not attempt to make a good connection at the top with the dielectric. I do not exactly understand that. We do attempt to give it good connection with a conductor. If a cloud is charged, that is a charged conductor, and so long as the current is to come down to the earth, we try to get as good connection with it as we can, by putting points on the lightning-rod, for instance. A better way to do that would be to have a flame or something of that sort. As an experiment in drawing electricity from the air, a flame is better than a point. But, of course, it would not work in a thunder-storm.

As to the point which Dr. Geyer just mentioned, that Mr. Hodges' experiments support the ordinary theory of the lightning-rod, I think his reasoning does, to some extent, too, in regard to getting rid of the energy on the central core. Take the ordinary lightning-rod. The way it is intended to work is rather to prevent a disruptive discharge than it is to take care of one that has already occurred. We desire to equalize the difference of potential by drawing off the charge from the cloud before it gets to a dangerous limit. If we can do that, we do not have any disruptive discharge at all. It is just like a brush discharge, such as you get from a conductor with points on an electric machine. I think the fact is not questioned that lightning sometimes is discharged in that way, but not always. There is the trouble. I do not think that any one system of lightning-rods has proved successful. Sometimes a lightning-rod will take care of several discharges in a single storm, and that seems to be something which Mr. Hodges' lightning-rod would not do; because, after it had been dissipated by one discharge, I do not think, even if it could be put up in a few moments, that anybody would care to be monkeying around a conductor when there was lightning. Mr. Hodges, having asked us to clear our minds of the idea of conducting electricity, seems to go further than most of the modern theorists on electricity. I think Mr. Hodges, even if he does not use the idea of electricity, will admit that we want to make a metallic way entirely down to the earth. The case is somewhat analogous to the Leyden jar; that is, two conductors separated by a dielectric. Now, we want to bridge over the whole space of the dielectric, whether you use the idea of conductivity or not. So I don't think it makes much difference whether you use his dissipatable lightning-rod or a stout one.

Mr. Hodges: — I would like to bring the discussion back once more. In order to make the paper of some length, I gave some theory; but the fact as I have found it is this: I know how the books state that the ship "Jupiter" was saved from destruction in spite of her lightning-rod going to pieces. But take the fact without going to the books at all. What do the records show? I want to get a case where the conductor has gone to pieces, and where the ship has not been saved. I have not found such a case. Suppose the conductor is dissipated between two points [illustrating]. I found this to be true in every single case of a church-tower being struck where the wire runs from the bells to the clock. The wire goes, and the church-tower is saved between those two planes. Now, that is a matter of record. The ship "Jupiter" had a chain conductor, and it was dissipated; and the

[1] A paper, by N. D. C. Hodges, read at the fifty-sixth meeting of the American Institute of Electrical Engineers, New York, April 21.

books say that the ship was saved in spite of the conductor being dissipated. But that is a man's opinion. What I want to urge on the institute is simply this: that in every single case when a conductor goes to pieces every thing else is saved. Why and wherefore, I do not care. I gave some theoretical reasoning which seems to me more or less correct, but it is unimportant. I want to bring the discussion back to simply this matter of fact: Can you cite a case where the conductor has gone to pieces, and there has been any destruction to the building between practically two horizontal planes passing through the upper and lower ends of that dissipated conductor? You will find that there is damage above and damage below, very likely. But as I went on through the "Philosophical Transactions" I found one case there of a thunder-storm passing over a village (it was a century ago, or more), and the people were dependent on the church-clock for the time. In the morning they did not hear the clock strike. They went up in the church-tower to see what the matter was, and found the windows smashed just above the bell; found the wires running from the bell to the clock were gone, and that was all the damage done. To show how small a conductor, when dissipated, will save a house, I will cite the case of a palace in France in the early part of the century. The interior was heavily gilded. The people were sitting around on gilded sofas resting against the walls, — resting against thin gilded strips. A Fellow of the Royal Society visited the palace the day after it was struck by lightning, and looked over the ground. No one was killed. No damage was done to that palace as far as the gilding extended; that is, in the gilded rooms no damage was done except that the gilding disappeared: it was dissipated. When they got to the lower portions of the palace, where there was no gilding, things were smashed. But, as I say, I started out in this thing with an hypothesis which was to a certain extent wrong. I looked into the records to see what was recorded, not as a matter of opinion, but to find out what actually happened. And what actually happened was, so far as I was able to judge, that there was no case where a dissipated conductor failed to protect a building under these limitations which I state. Of course, above or below, damage did occur.

A Member: — From a practical standpoint, would you kindly tell us where you put that conductor on a house, and would you put more than one strip on a building?

Mr. Hodges: — Along the ridge-pole, down the eaves, down to the ground. I should avoid, at the lower end, making connection with any large masses of metal. The number of strips placed on a building would depend on the size.

I got a patent on this thing last year. I told a friend of mine that I was interested in the protection of buildings from lightning, and, a patent not being issued, I could not tell him much about it. The next day he met me and said, "Did you read in the *Post* the account of the lightning-storm in Jersey yesterday?" I said, "No." He said, "There was one case where a house was struck by lightning in Jersey and the rod was smashed, but the house was uninjured." I noted it down as another case. A man who was in my employ some years ago came to my office. I described this thing to him, and he said, "I have been there." He said when he was a boy he had a telegraph line running from his house to a neighbor's house. It was made of piano wire, and the lightning struck the roof somewhere there [illustrating], then followed along the metallic gutter to a point here. This piano wire ran down to the ground, and ran over here to the neighbor's house. At this point a little damage was done to it. The discharge followed along the conductor without doing any material damage, and there was no other damage to the house except that the wire was gone.

Mr. Wolcott: — Although I do not question that conductors work that way, we also find that they work the other way, according to the old theory, in very many instances. It certainly is a matter of record that conductors have sometimes carried off several discharges in the same thunder-storm, which a dissipatable conductor could not do unless you were able to put up a second one in the place immediately after the dissipation of the first.

A Member: — The Washington Monument is a pretty good lightning arrester. I was shown, a few weeks ago, by Professor Owens, where lightning had struck and knocked out big chunks of stone from the monument. He seemed to think that lightning followed the path of least electrical resistance, so he put up an additional wire and connected that with the new iron work of the monument, and he says he has not had any trouble since then with stones being knocked out.

Mr. E. P. Thompson: — I have not heard of any experiments being performed upon Mr. Hodges' proposed system. It may seem, perhaps, impossible to perform experiments with lightning in a laboratory, because of the inconvenience of waiting for a thunder-storm; but it can be done with the induction system, and possibly, therefore, some way may be thought of for testing Mr. Hodges' invention. About three years ago I tried some experiments in connection with a client, a well-known lightning-rod manufacturer, Capt. Hubbell, who has equipped government magazines. His new system was tried with considerable elaborateness in the Equitable Building during its repair, for the consideration of the Standard Oil Company, who met with great losses of oil-tanks, caused by lightning. An immense Leyden battery was charged with an electrical friction machine, and artificial lightning was thus generated. Small oil-tanks containing alcohol — more easily lighted by the spark than petroleum — were equipped, and by discharging the battery it was easily determined how many times out of a hundred the Captain's system was successful. Some experiment with Mr. Hodges' system would soon settle the question of effectiveness.

Mr. Charles Steinmetz: — To one point more I wish to draw attention. By using such an interrupted conductor of small cross-section, that is of comparatively high resistance, you are liable to change the whole nature of the lightning discharge. You change it from an oscillating discharge to a steady and continuous rush of current, from which you must expect quite different effects.

When, for instance, you discharge a condenser by a conductor of very low resistance, you get an oscillating discharge of an extraordinary high frequency. If you increase the resistance of the conductor, the number of oscillations of the discharge decreases, it runs down quicker, until at last you reach a value of resistance where only one wave of discharge current appears, that is, the discharge of the condenser becomes steady. Now, if we can make a lightning discharge steady, instead of oscillating, then we have first to expect that the electricity traverses the lightning-rod only once, slowly increasing in current strength and then decreasing again by going down to the ground, while in an oscillating discharge the current will rush to and fro through the conductor until its energy is consumed by the resistance of the lightning-rod, or by electro-magnetic radiation and re-radia-

tion from the induced currents produced by the oscillating discharge in neighboring conductors.

This, perhaps, may account for some of those phenomena mentioned to-night: that, when the lightning-rod is dissipated, that is when its resistance was very high in comparison with the quantity of electricity rushing through, there was a steady discharge and no harm was done; while, when it is an oscillating discharge, the slightest irregularity will cause the discharge to "jump the track," that is, to leave the lightning-rod, which is obstructed by the counter electro-motive force of self-induction, and to spark over to metal masses of larger condenser capacity: for what I consider as the most dangerous part of lightning discharges is not the enormous voltage of the discharge, nor the strong current rushing through the lightning-rod, but the electro-magnetic field of force, which alternates with enormous frequency and reaches far out into space from the real path or centre of disruptive discharge, and thereby must cause inductive effects everywhere, which, as before said, cause not only the main discharge to spark over, but produce true secondary or induced lightning discharges. Hence I must be very much in favor of every arrangement which is able to change the oscillating discharge into a steady rush of current.

The resistance of the lightning-rod I consider as of subordinate importance only, except so far as carrying capacity is concerned: for of what use is a resistance as low as a few ohms, when the self-induction of the lightning-rod causes a spurious resistance of perhaps hundreds of thousands of ohms?

Mr. Hodges: — I would bring this discussion back once more to this matter of fact that I am interested in. The theory I do not care so much about. It may be interesting as mental gymnastics. I came here feeling quite sure that somebody would stand up and say, "I know a church or a house in this town or that town where the conductor was dissipated and yet damage was done on the same level." I have not found a case.

Dr. Geyer: — In a disruptive discharge, the length of the lightning-rod, it seems to me, is a very small part of the total path. I should imagine that any resistance the conductor would have would be such a small part of the total that it would not have much effect on the character of the discharge.

Mr. Steinmetz: — I believe I have been misunderstood in what I meant by the influence of the resistance upon the nature of the discharge. Indeed, the whole resistance of the lightning-circuit is so large that under any circumstances the resistance of the lightning-rod is imperceptibly small. But, as explained in my former remark, it is not the resistance proper, but the consumption of energy by the resistance, which causes the amplitude of the oscillating discharge to decrease slower or quicker until, for a very rapid consumption of energy by resistance, only one wave appears that is a steady or continuous current. This phenomenon is similar to a pendulum oscillating in a liquid: the greater the frictional resistance of the liquid, the quicker the amplitude of the pendulum motion decreases, until, at last, in a very tough liquid, the pendulum comes to rest without any oscillation at all — periodically. In such a way the resistance of the conductor, by consuming the energy of the electric discharge, could change the discharge from an oscillating to a continuous one, although the whole "resistance" has still about the same value, "infinite," if we were allowed to speak with the usual meaning of "resistance" of disruptive discharges, which we are not.

Mr. Birdsall: — I think Mr. Hodges has given us the most original idea on this lightning-rod question that has been put forward for some time. I also think that Mr. Steinmetz has hit the nail on the head in his explanation of it. It only shows us again what we do not know about the various phases of alternating currents. His theory also gives me a little uneasiness, because I have advised a number of friends who have built houses in the country to put in a metal lath, as I thought that, having plenty of metal around, if the house happened to be struck, it would go to the ground through this metal lath. Now, if any of those houses are struck, and that metal lath turns into gas, I think I shall emigrate.

Mr. Hodges: — That metal lath reminds me, — I wrote to Edward Atkinson about this. You know he is president of about the only insurance company in the country that cares about stopping fires; that is, reducing the amount of damage done. He wrote back that they had experience with lightning-rods, and that their experience was such that they had abolished them on all factories that were insured by the Manufacturers' Mutual Fire Insurance Company. Now, in the mills there is a considerable surface of metal; and they find, as is natural, that the discharge spreads itself probably over the surface of this metal. At any rate, the potential was so reduced as to very materially mitigate the effects. As Mr. Atkinson puts it, it spreads out over the surface of the machinery, so that no great damage is done. But they have taken off their old rods.

Mr. Wolcott: — There is one question I would like to ask in regard to that drawing on the board. If you do not say that no damage was done to the end of the building, in spite of the fact that the conductor was dissipated, why don't you have to say that no damage was done along the eaves, in spite of the fact that the conductor was not dissipated?

Mr. Hodges: — That is a fair question. A dissipated conductor may run horizontally any reasonable distance, and then run down; and when it goes to pieces the thing is saved. But when the conductor is not dissipated, there are any number of cases where the building is not saved.

Mr. Wolcott: — I can understand it, that a dissipating conductor would very often save the building, but, according to the accounts that have been cited, it does not seem to make any difference how little there is of that metal. There must be some limit. When it gets down where a little bit of gold-leaf is going to save a building, it looks rather improbable. If a little bit of metal being dissipated would save a building from a lightning discharge, then an ordinary lightning discharge would not be sufficient to dissipate some of these larger conductors which are dissipated.

Mr. Hodges: — I do not pretend to understand any thing about it. I have theorized upon it, but that is not important. It is only the fact, and the fact stands there until somebody gets up and shows a specific case where it does not work.

Mr. Birdsall: — I do not think that Mr. Wolcott can hold that argument, because he has not any data on the comparative energies of these various discharges of which we have record. We have a record of the damage done in the dissipation of the conductor, but we have no record of the foot-pounds of energy in the discharge.

Now, the discharge that burnt up the gold-leaf on the wall might have been a great deal smaller than some of the discharges which burned up the larger conductors. Then another point has been raised about the replacing of the conductor immediately after it was dissipated. This will never be necessary, it seems to me, for it is a recorded or alleged

fact that lightning never strikes twice in the same place. They say that in naval combats the safest place to put your head is through the hole that the cannon-ball has just come through; and if it did strike more than once the rods could be arranged on the principle of the multiple fuse, and a new one plugged in as fast as they dissipated.

Mr. Wolcott: — Mr. Birdsall has been facetious on this point, and I will try to be so, too. I have heard it stated that one reason why lightning does not strike in the same place twice is that the place is generally gone when the lightning has struck once. I certainly have read of several cases where the conductor has conducted several discharges to earth in the same storm. Now, with regard to gold-leaf discharge. That this charge was smaller, of course, may be true. But the fact that the discharge in each of these cases is just about suited to the size of the conductors would seem to show that there was some coincidence about the matter. If a dissipated conductor always stops the damage, or very nearly always, there is something more than coincidence about it. It seems to me that such an instance as that could not be more than a mere coincidence — that a discharge which was capable of doing considerable damage to the building where the conductor was not dissipated, should be all used up by dissipating a very small amount of metal, is not probable.

The President: — I will call the attention of the Institute to the fact that our usual time of adjournment has very long passed.

Mr. Hodges: — Ships have been struck a number of times in the same storm. If you can cite specific cases against me, all right. I have found, so far as I know, that a dissipatable conductor protects. Why, is another question that does not concern us. Why that gold-leaf protected we do not care. It did protect. There is no arguing against its being reasonable, that will set aside the fact. I thought over the matter, and have some theoretical considerations to show why it does protect, but those are not essential.

This is all I want to give at the present time. But I believe there is one other way of furnishing protection against lightning which has been ignored for a number of years. The facts have been staring us in the face. I think about the same time that Harris introduced his system of lightning-rods there was a modification made in the rigging of ships which has tended to mitigate the disastrous effects of lightning. The facts were well known long before Harris came into existence; but they were so thoroughly out of tune with all the science of that day that they were simply ignored; so that, in fact, in the report of the lightning-rod conference, there is only the title of one paper bearing on the subject. To find that paper I hunted through the Astor Library, and put one of their expert searchers to work there; and it was evidently considered of so little importance, that it had not been copied in any periodical. By going back further and further in the "Philosophical Transactions," I found the same facts reported of a most positive character, and I think they have a bearing on this apparent immunity of ships when they are supplied with good conductors. I am inclined to think that it is not the Harris conductor that has been doing good service entirely, but it is something else. But all that I would have said this evening, if it had not been necessary to present a paper of some length, was that a dissipatable conductor protects.

Mr. James Hamblet: — I understand the gentleman to say that a dissipatable conductor protects. I have in mind a very large building situated at the top of a hill, in a very exposed position. That building is constructed with a metal roof, entirely over the building, but having no lightning-rods. It has large iron pipes, six inches in diameter, to conduct water through the building down to the ground. That building has never been injured by lightning at all, but frequently trees around it on the hill have been destroyed by lightning. The lightning conductors of the building, which are these same iron pipes I have mentioned, have not been dissipated.

THE BROOKLYN INSTITUTE BIOLOGICAL LABORATORY.

THE location of this biological laboratory, at the head of Cold Spring harbor, Long Island, is one of the most favorable on the coast. The country around affords excellent hunting ground for every form of animal and vegetable life common to the climate. Just above the laboratory is a series of three fresh-water ponds, each fertile in its own peculiar forms of fresh-water life, and through which flows the water of Cold Spring Creek. Just below the laboratory is the harbor of Cold Spring, divided by a sandy neck into an inner and an outer basin. The inner basin is particularly rich in marine life, and the channel between the inner and outer basins has a varied and vigorous growth of algæ, mollusks, and echinoderms. The outer basin has rocky projections, shallow flats, banks and eel grass, sheltered pools, oyster-beds, and other conditions favorable for collection and study. The outer basin opens into Long Island Sound, whose coast is varied in character for twenty miles in either direction.

The main laboratory occupies the first floor of the New York State Fish Commission building, and is a room thirty-six feet wide and sixty-five feet long, provided with ample light from every side. It is furnished with laboratory tables, aquaria, hatching-troughs, glassware, and all the apparatus and appliances required for general biological work. Into the laboratory is conveyed a bountiful supply of the water of the Cold Springs for use in the aquaria and troughs. This water is as pure as a crystal, has the same low temperature throughout the year, and is the water used so successfully by the New York State Fish Commission in hatching and growing salmon, trout, and other food fishes. The laboratory is also supplied with an abundance of salt water, which is pumped up from the harbor into a brick reservoir, from which it runs to the laboratory.

The station is provided with three small row-boats and a naphtha launch, together with nets, trawls, and dredges, for use in collecting and dredging. Near the main laboratory is a photographic room, with a dark room and work room adjoining. Each student is provided with dissecting instruments, chemicals, and glassware, to be used in the dissection, preparation, and study of tissues. Microscopes will be provided for those students who cannot provide themselves with instruments.

The following general course is open to each student, and is under the direction of Professor Conn. It will consist primarily of laboratory study of specimens illustrating the types of animal life. The practical work will be accompanied by lectures giving an outline of systematic zoölogy, for the purpose of showing the relations of the forms studied to other animals. The lectures will also touch upon various matters of general biological interest. The types studied in course will be as follows: *Protozoa*, — study of microscopic forms, including directions in the use of the microscope; 1. *Cœlenterata*, — hydroids, including the study of jelly fishes and the development of hydroids; 2. *Echinodermata*, — the star-fish; 3. *Bryozoa*, — study of an adult Bryozoan; 4. *Mollusca*, — the clam, the snail, development of the oyster or some other type; 5. *Crustacea*, — the crab, with a study of its development; 6. *Insecta*, — the grasshopper; 7. *Vertebrata*, — dissection of the fish, dissection of the frog.

Accompanying this course of laboratory work and lectures will be given instruction in methods of mounting objects and in the preparation of microscopic sections. Opportunity will also be given for collecting and surface skimming.

A special feature of the laboratory this season will be an extended course in the methods of bacteriological research. The

course will consist of laboratory work on the culture and propagation of bacteria, identification of species, and of lectures and demonstrations by the director. Only those who are well prepared by previous study and experience in biological or medical work will be admitted to the course.

Students who pursue the general course of instruction during the summer, and who have time for extra work, are given the instruction and facilities necessary to enable them to carry on special investigations; while those students who have already gained the knowledge and experience which is provided by the general course, will be permitted to give their entire time to special work.

The laboratory will open for the season on Tuesday, July 7. The regular session for students will continue from that date until Friday, Aug. 28. The number of students for the season of 1891 is limited to twenty-five.

A good reference library will be placed at the service of students, and a collection of *algæ* will serve to guide students in marine botany. In addition to the regular lectures given in connection with the laboratory work, evening lectures will occur two or three times a week, illustrated by the aid of a magic lantern. The lantern is provided with a vertical attachment and with large and small cells, in which forms of life may be placed and their structure exhibited on the screen. A microscopic attachment to the lantern will enable lecturers to demonstrate points in minute anatomy, and a large collection of lantern slides of biological subjects will furnish the means for comparison of many allied forms and structures. The evening lectures will be open to the public, and persons interested may secure admission to the entire course.

For further particulars inquire of Professor Franklin W. Hooper, Secretary, Brooklyn Institute, Brooklyn, N.Y., or of Professor Herbert W. Conn, Ph.D., Wesleyan University, Middletown, Conn. Applications for admission as students should be sent to the secretary of the institute.

THE ETIOLOGY OF TETANUS.

IN a late number of the *Annales de l'Institut Pasteur* there appears (from the Bacteriological Laboratory of Val-de-Grâce) a most interesting paper on tetanus by Drs. Vaillard and Vincent, an abstract of which is printed in a recent issue of the *Lancet*. This paper appears to throw very considerable light on the subject of tetanus, and to clear up a number of points and observations that have hitherto been enshrouded in obscurity. After describing the organism, and identifying it with that already made familiar through the papers of recent writers, the authors give it as their firm opinion that in cases of artificial inoculation of pure cultures it is always the poison introduced along with the bacillus, and not the organism itself, that acts upon the animal. This indeed seems to be probable, as they are able to prove that almost inconceivably minute doses of this poison, which they compare with snake poison, are quite sufficient to produce all the symptoms of most acute tetanus; in fact, it was almost impossible, from some of the cultures that they obtained, to administer a dose that was not lethal.

An exceedingly interesting feature brought out in the course of their work is that in no case was the poison developed as soon as the organism began to grow; in fact, gelatine cultures of the tetanus bacillus were never capable of producing toxic symptoms until liquefaction of the gelatine had commenced, when spores were demonstrated to have been formed, and when the peculiarly disagreeable odor so characteristic of tetanus cultures had become perceptible. They associate both the odor and the peptonizing power with the formation of the poison in the cultures. That it was not due merely to the presence of the spores that the material was poisonous they demonstrated by heating their cultures to a temperature of 62° C., for a short time (a temperature which is quite incapable of interfering with the vitality of the spores), when it was found that cultures so heated and introduced by inoculation into a rabbit or a guinea-pig failed to produce any tetanus, thus proving that, although the spores are not killed, the poison has been destroyed by the heat. The spores were proved to be living by making fresh cultures from them in artificial media; after a time they grew luxuriantly, and if left to grow eight or ten days produced another crop of the poison. By simply washing away the poison from the spores with distilled water they also obtained similar results, for, although the spores could still develop and form the specific poison in artificial media, they were, when inoculated, incapable of giving rise to any symptoms of tetanus. From the re-action to heat of a substance they were able to separate, and from its resemblance to the diastases in other respects, they conclude that they have obtained from tetanus cultures the true tetanus poison, a poison, however, that cannot be formed by the tetanus bacillus in healthy tissues. The micro-organisms are here so rapidly attacked by the leucocytes that they are rendered *hors de combat* before they have time to form their poison.

It has long been well known that the tetanus bacillus could not develop in the tissues except, apparently, in the presence of other organisms, and the suggestion is offered that these other organisms act in one of two ways; they either paralyze the activity of the leucocytes, or they draw off, as it were, their attention and activity from the tetanus bacillus, thus allowing it sufficient time to develop its characteristic products.

It is interesting to note that Drs. Vaillard and Vincent consider that in many respects the tetanus bacillus is extremely like the diphtheria bacillus, the method of action on and in the organism being essentially the same in the two cases, the above factors in all probability playing a part in diphtheria much as in the case of tetanus; and it is evident that in studying the one poison much light may be thrown on the other. Behring and Kitasato appreciated this fact, and combined their forces to work out the question of immunity in these two diseases. It is obvious, however, from a consideration of some of the points that are indicated in this paper, that there are many sources of fallacy that will have to be eliminated before the ultimate explanation of the condition of immunity in protected animals can be given.

The facts that this poison is active in such extraordinary minute quantities, and that the micro-organisms are able to grow with such difficulty in the human tissues, allow us to hope that extremely minute changes in the blood may be quite sufficient to secure the alteration or breaking-down of the virulent poison, even when it has become diffused throughout the system. So long as the organism is localized to the wound, there is, of course, more chance of coping successfully with the disease, although here, as in other diseases, there always appears to be a possibility of the poison exerting such a paralyzing influence on the cells that usually take up foreign substances, that secondary septic conditions may be liable to occur even when the action of the tetanic poison can be antagonized so far as its primary effects on the cells are concerned.

One question appears to be set at rest, and that is, as regards tetanus and diphtheria, the ptomaines have had their day, whatever may become of the products of other organisms. It may be accepted that here, at any rate, we have some subtle poison which, although it has not yet been actually separated, has become so far isolated that it may be taken as proved that it is not an alkaloid or basic poison.

A most remarkable feature is that, in peptonizing gelatine with the filtrate from a meat-broth culture of the tetanus bacillus, the poisonous properties are lost to a certain degree in direct proportion to the amount of gelatine that is peptonized; this, taken in conjunction with the fact that the properties are not developed until the gelatine begins to liquefy, has led Drs. Vaillard and Vincent to suppose that the same agent that peptonizes the gelatine is the active agent in bringing about the development of the toxic symptoms of tetanus.

ONE of the many important uses to which electric welding machines are put is welding railroad rails. Owing to the difficulty of maintaining rails in crowded and paved city streets, it is an advantage to have the rails as long as possible, thereby reducing the number of joints to be cared for, and during the past year a company in Johnstown, N. Y., has been successfully experimenting in electrically welding rails up to 110 pounds per yard. This company is now having constructed one of the largest machines ever built for the purpose. As a result of careful tests, it is claimed that a saving of at least thirty-four per cent is effected by the electric welding process as compared with the older method.

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Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

Steps are being taken to celebrate the seventieth birthday of Professor von Helmholtz, which occurs on Aug. 31. A marble bust of Professor Helmholtz is being made, which will be presented to him on that occasion, and a fund is being raised, the income of which is to be applied, primarily, to the bestowal of a Helmholtz medal on eminent investigators of all nations in the fields of Professor Helmholtz's activity. An international committee, which has been formed to carry out these schemes, solicits contributions, which may be sent to the committee's bankers, Mendelsohn & Co., Berlin. Professor Henry P. Bowditch of Harvard University will forward the contributions of such as may find it more convenient to send to him, with the names of the contributors, to the bankers appointed by the committee. All contributions should be sent as soon as possible.

JULIUS ERASMUS HILGARD.

Mr. Hilgard, whose death on May 8 has been announced, was born at Zweibrücken, in Rhenish Bavaria, Jan. 27, 1825. His father was a man of a wide range of accomplishments, — counsellor at law, judge, poet, classical scholar, and author. Being of liberal tendencies in politics, he became dissatisfied with the *régime* under which he lived, emigrated in 1835, and settled in Illinois, where he personally directed the education of his children. The subject of the present notice also studied in Philadelphia, where he made the acquaintance of Professor Bache. In 1845 he obtained an appointment in the Coast Survey, and soon became one of Bache's most trusted assistants.

His administrative and business tact led to his promotion in 1862 to the position of assistant in charge of the Coast-Survey Office. He now took a prominent part in directing the scientific work of the survey, especially in its relation to the International Metrical and Geodetic Commissions, having their headquarters in Paris. Perhaps his most noteworthy work was that done in connection with the determination of the transatlantic longitude in 1872. Soon after the Atlantic cables were put into successful operation, the difference of longitude between Greenwich and the Harvard College Observatory was determined by Dr. B. A. Gould. Shortly afterward the French cable was laid between Brest and St. Pierre, and it was judged expedient to repeat the determination by taking Paris as the starting-point. It happened, however, that the telegraphic determination of the longitude of Paris from Greenwich, made in 1853, was very doubtful, and it became a necessary part of Mr. Hilgard's work to repeat this determination. This he did with the assistance of Mr. Frank Blake, then sub-assistant on the survey, who observed both at Greenwich and Paris. The result was an important correction to the longitude of Paris, and hence to other European longitudes which depended upon it.

On each occasion of a vacancy in the superintendency of the Coast Survey, Mr. Hilgard was naturally a prominent candidate for the succession. He was, however, disappointed in his aspirations, both on the death of Professor Bache in 1867, and on the resignation of Professor Peirce in 1874. On the death of Capt. Patterson in 1881, his long and efficient service as assistant in charge of the office, and his intimate acquaintance with all the details of the work, made his appointment seem especially fitting; and he was selected for the position with the general concurrence of all parties interested. He had not been long in office before the symptoms of the insidious disease which finally carried him off increased to such a degree that he was obliged to resign in 1886.

Whatever weakness may have been developed in the last years of his life, there can be no two opinions upon the character and value of his life-work in connection with the Coast Survey. He brought into that branch of the public service a rare combination of culture, zeal, knowledge of the world, and executive ability; and no man living will claim to have done more than he did for the character and efficiency of the survey.

THE FERMENTATIONS OF MILK AND THEIR PREVENTION.[1]

Sweet milk is the foundation of the dairy interest. All dairy products are dependent upon milk, and furthermore, they are dependent upon sweet milk, for after it has undergone any of its fermentative changes it becomes worthless either to be used as milk or in the manufacture of butter or cheese. When milk first comes to our hands from the cow it is always sweet, and it has no tendency to undergo any troublesome changes. But this condition lasts only a short time, and sooner or later some form of decomposition begins, and the milk becomes useless. It is our purpose, this afternoon, to study some of these fermentations and to determine if possible some of the facts regarding their prevention. It may be well to say at the beginning that I have no royal road to recommend for the prevention of milk fermentations, since no practical method of preventing them has yet been discovered. But a knowledge of the nature of these troublesome changes and of their causes will go far toward enabling each one to guide himself in avoiding them.

I shall consider the subject under three heads: 1. What are the fermentations of milk? 2. What are the causes of these fermentations? 3. How may the fermentations be prevented?

First, then, we will consider what are these fermentations. We may notice at the outset that they are widely varied. They are by no means confined to the ordinary souring and the fermentation produced by rennet, although these are the only ones that are so well known as to have received special names in the dairy. Everyone, however, who has had any extended dealings with milk, has noticed that it sometimes undergoes changes that are quite different from the normal ones, but which may be none the less troublesome. The various fermentations which are now known to be common to milk have only been recognized within a few years. While the souring of milk has been known for centuries, and the fermentation of milk by the action of rennet has also been long understood, milk has been studied scientifically only about fifty years. During the last fifty years various sorts of decomposition changes have been recognized, one after another, until to-day the number known is quite large. Let us, then, in introduction to our subject, review briefly the most common forms of fermentation which are liable to occur in milk, taking them partly in the order of the commonness of their occurrence.

First, we may notice the ordinary souring of milk, though it is too well known to demand description. This effect is connected with the milk sugar present in the milk. The milk sugar undergoes a decomposition and forms lactic acid, the acid thus formed

[1] An address by Professor H. W. Conn, in December, 1890, before the Connecticut State Board of Agriculture.

rendering the milk sour to the taste and precipitating the caseine in the form of the curd.

Hardly less familiar to you all is the fermentation produced by the action of rennet. You will all recall this action produced by the addition to the milk of a little rennet which you have obtained from a calf's stomach. The milk curdles quickly, and after a little a whey separates from the curd. In this case the action is quite different from that of the souring. It is entirely independent of the milk sugar, and is connected with the caseine of the milk. The caseine undergoes a chemical change under the influence of the rennet. In common sweet milk the caseine is in a condition of partial solution, and while it is in solution the milk is of course a liquid. But under the influence of the rennet a chemical change takes place, the nature of which we do not yet fully understand. So far as we can determine to-day, the change consists of a separation of the caseine into two parts, one of which is soluble, and therefore remains in solution in the whey, while the other is insoluble, and as soon as it is formed it is immediately precipitated as the curd. While, then, the souring of milk concerns the milk sugar alone, the fermentation by rennet is connected only with the caseine.

A third form of milk fermentation is the alcoholic fermentation. Milk does not readily undergo the alcoholic fermentation. When yeast is added to a solution of ordinary cane sugar it causes the sugar to be decomposed into alcohol and carbonic acid. If yeast is put into milk, however, instead of undergoing an alcoholic fermentation, it will under ordinary conditions undergo a change into lactic acid, and will consequently sour. Nevertheless, an alcoholic fermentation of milk does sometimes occur. The Arabs, wandering around the deserts, have been for a long time accustomed to prepare from the milk of their mares an intoxicating drink which contains considerable alcohol. This drink they call "koumiss." It is prepared by simply putting the milk into flasks, and adding to it a little already fermented milk, which starts the process anew, and soon gives rise to a considerable amount of alcohol. In the Caucasus Mountains it has somewhat recently been noticed that the common people have a method of preparing an alcoholic drink from ordinary cows' milk. The milk is placed in leather flasks, and there is added to it some small lumps called "kephir grains." These kephir grains contain various yeasts and bacteria, and they are possessions of the common people, who hand them down from generation to generation. Where they originally came from is unknown. They have the power of setting up fermentation in the milk, at first the ordinary lactic fermentation, but this is soon superseded by the formation of alcohol, and on the second day the milk is in condition to drink. Since it has been found that milk can be made to undergo an alcoholic fermentation, a simple method has been discovered of producing it at will from cows' milk. All that is necessary to do is to add to the milk a little ordinary cane sugar and then a little yeast, and the fermentation that takes place will produce alcohol, and give us a beverage to which the Arab name "koumiss" is applied. This condition of milk is frequently prescribed as a food in hospitals, since it seems to be more easily digested than ordinary milk, the caseine being coagulated into small flakes that are readily acted on by the digestive juices.

The next fermentation that we will notice is that producing bitter milk. All of you must be familiar with this peculiar trouble. At certain seasons of the year, especially in the fall, milk seems to have a tendency to become extremely bitter without becoming sour. Quite naturally, this has been ascribed to some special food which the animals get hold of at this season. It is, however, a troublesome matter, for it spoils the milk and injures it for all dairy purposes.

A fermentation, not quite so common, but far more troublesome when it occurs, is that known as slimy milk. Perhaps some of you have had experience with this milk, that can be more readily sold by the yard than by the quart or gallon. The milk, after milking, rapidly becomes viscous, thickening to such an extent that the vessel in which it is placed may be inverted without spilling the milk. So slimy does it become that it can sometimes be pulled out into long threads, like molasses candy. Such milk is of course worthless. It cannot be churned, the cream will not rise on it, and it is useless for cheese-making. Of course no one wants to drink it. Up in Norway, however, the people are said to be fond of drinking, or rather eating, this slimy milk, and have learned to prepare it artificially by putting a small plant into the milk. With us, however, it is nothing but a troublesome nuisance, and the farmer who finds it in his milk usually tries every imaginable remedy to check it.

Milk not infrequently undergoes a change by which it becomes rancid. It has the smell of rancid butter, and chemical study has shown that the trouble is due to the formation of the same material which gives the taste to the rancid butter, viz., butyric acid. Such a fermentation, though very common, is not ordinarily seen in the dairy, since it is concealed by other more prominent changes, and thus escapes notice.

One of the commonest fermentations of milk is what we may call that of alkaline curdling. Under its influence the milk curdles without becoming acid. I am sometimes asked why milk sometimes becomes "loppered" without losing its sweet taste. It is due to the effect of the fermentation that we are now considering. Such a curdling seems to be similar to that produced by the action of rennet. Indeed, careful study seems to indicate that the two are almost, if not precisely, identical, and that these alkaline fermentations are produced by the formation of a ferment similar to rennet. This form of fermentation represents a class of which there are many varieties. They are accompanied by various odors and smells, and the milk seems to be undergoing decomposition. The various forms of tainted milk may be usually ascribed to the class of fermentations now considered. They are certainly very common, almost always occurring in milk which has stood for a short time, but commonly they escape notice, since the souring of the milk is so much more prominent that it entirely conceals the alkaline curdling. Experiment, however, easily isolates this fermentation.

Once in a while dairymen are troubled by a blue milk, not blue milk like that of the city restaurant, which is blue simply because the cream has been removed from it and water added, but milk which is blue from a special fermentation. Such milk appears like other milk when it is drawn, but just about the time it begins to sour, small blue patches may be seen in it. These patches increase in size, and finally, by the time the milk is quite sour, it has assumed a brilliant blue color. No one wants to drink such milk, though it is probable that it would not do any injury if it were drunk. There is no poison in it that chemists can discover, and it has been fed to small animals like rats without doing any injury. But still no one with his eyes open will drink it, and if it is known that the milk from a certain farm is subject to this fermentation it will be thoroughly avoided. Sometimes this blue milk becomes so common that it may almost be regarded as an epidemic.

Blue milk is not the only colored milk that arises as the result of fermentation. Yellow milk sometimes occurs. I have had in my laboratory milk that is just the color of a lemon; other specimens with an amber color. Red milk is occasionally found, sometimes occurring spontaneously as a troublesome infection, and easily produced artificially in the bacteriologist's laboratory. Sometimes milk assumes a green color, though never quite so brilliant as a grass green. Such milks usually have a vile odor, and are plainly undergoing a putrefactive decomposition. A violet milk is also occasionally seen.

Lastly, I may mention a series of fermentations under the head of miscellaneous. Various forms of decomposition changes occur which do not really belong under any of the above classes, and which have not been sufficiently studied to enable us to say much about them. They simply indicate that in the above list we have by no means exhausted the fermentations which are likely to occur in milk, and that future study will reveal much more in this line.

It is only within a comparatively few years that this long list of fermentations has been known. Little by little, as milk has been studied by modern scientific methods, has the number of these known fermentations increased, and nearly every year adds one or more to the list of the fermentations to which milk is known to be subject.

We will now pass on to the second division of our subject, and ask what is the cause of these fermentations. The alcoholic fermentation and that of rennet may now be omitted from discussion, for every one knows that these are produced by adding something to the milk, a yeast in the one case, and rennet in the other. Leaving aside these, then, we would naturally expect, inasmuch as the other fermentations are very varied, to find their causes varied also. In a certain sense this is true, but at the same time there is one point in which they all agree. All of the fermentations mentioned above are due to microscopic plants getting into the milk subsequent to the milking and their growing.

Before passing to a further consideration of this matter, it may be well to notice that there occurs, very rarely, a curdling of milk which is not due to micro-organisms. Once in a while milk is found to curdle almost as soon as it is drawn from the cow, and in this case the trouble is not due to micro-organisms. Such an occurrence is extremely rare, however, and it is doubtful whether any of you have ever had any experience with it. But aside from this rare occurrence, all of the fermentations are caused either by bacteria or yeasts, which get into the milk subsequent to the milking.

It has taken many years to reach this conclusion. It will be convenient for us to consider the fermentations as belonging to two classes, one of which we may call the normal fermentations, and the other the abnormal fermentations. The former class includes only the common souring and the rennet fermentations, while the abnormal class includes all of the others. Now it has been recognized from the very earliest times that the abnormal fermentations were due to something getting into the milk which did not belong there. So long ago as 1838 a microscopic study of blue milk revealed in it some micro-organisms, and these were even then suggested as the cause of the trouble. From that time, as one after another kind of fermented milk was studied, it was seen that they were all associated with some form of bacteria, and the conclusion is now very definitely proved that they are all caused by these organisms. All of the forms of fermentation mentioned above have been associated with definite species of bacteria, and all can be artificially produced by inoculating good milk with the right species of bacteria.

After it was seen that bacteria were the cause of the troubles, the next question was to account for their presence in the milk. It did not seem possible at first that they could all get into the milk after the milking. All sorts of explanations were suggested relating to conditions surrounding the cow. The cow was supposed to have caught cold, or to have been heated, or to have run too fast, or to have been eating some injurious kind of food, and for some of these reasons the milk fermented. Every thing was blamed except the carelessness of the milker. I imagine that many of you even to-day think you have very good reason for believing that certain fermentations are really caused by the food that the cow eats, and this has always been the favorite excuse. You have, perhaps, found slimy milk in your dairy, and have then remembered that recently you begun to feed your cow on a special lot of meadow hay. Thinking that this might have caused the trouble, you ceased to feed this hay and the trouble ceased. What better proof could you desire that it was the hay that the cattle ate which produced the slimy milk? In fact nothing of the sort is proved by this experiment. Do you not remember that when ensilage was first introduced, many farmers complained of it, saying that its use caused their milk to become tainted, and thus much injured its quality? And do you not also remember that as experience began to accumulate it soon appeared that it was not the ensilage which the cows ate which produced the trouble but the ensilage which the milker handled? To-day you know that you can feed ensilage to the cow with no danger provided that you exercise sufficient care in handling it, and allow no opportunity to occur for the ensilage to contaminate the milk after the milking. So it is with all other ferments. It is not the food that the cow eats that produces the fermentation, but it may be the food that is in the barn, and is being constantly stirred up so as to keep the air full of floating bacteria. These may get into the milk and produce trouble, and they will be avoided by letting the hay alone or doing the milking out of the proximity of this troublesome food. The cow may eat it with impunity. The remedy is not to change the food but the conditions of the milking-yard and the dairy.

Do not understand that I would infer that the food the cows eat has no influence on the taste of the milk. There is no question that if the cows eat a strong-tasting food like garlic, the taste is transferred to the milk. But this is a very different thing from the production of fermentation. The taste produced by such food is at its maximum as soon as the milk is drawn, while in the case of a fermentation the effect is an increasing one, being absent at first, but appearing as the bacteria have chance to grow.

While thus it is seen that the unusual fermentations have long been ascribed to the action of bacteria or something else getting into the milk which does not belong there, this has by no means always been supposed to be true of the common souring of milk. The souring is a universal and not an occasional thing, and there seemed for a long time to be no way to prevent it. So long ago as 1844 bacteria were found in souring milk, and it was even then suggested that the souring was due to them. In 1850 again the fact was reaffirmed. Pasteur commenced his work on milk about 1860, and finding that he could prevent the souring by subjecting the milk to a high heat, and, moreover, being always able to discover in it numerous bacteria, he insisted that even this common fermentation was due to these organisms. The statement did not go unchallenged, however, and for the next ten years there were conflicting results. In 1874, and later, Lister and Hall succeeded in procuring milk directly from the cow with such precautions as to avoid chance of contamination by bacteria, and they found that such milk remained sweet indefinitely without showing any tendency to undergo even the souring fermentation. After this there could no longer be any question in regard to the matter, and we may therefore ascribe the souring of milk to the same class of causes as those producing the more unusual fermentations.

It may seem somewhat remarkable that bacteria should so universally get into milk. But the fact is that they are very abundant everywhere. They are in the air, in the milk vessels, on the hands of the milker, on the hairs of the cow, and above all they will be inside of the milk duct, extending for a short distance from its mouth. Some milk will always be left in the mouth of the duct, and in this milk the bacteria will grow and remain there ready to contaminate the next milk that comes out. The number of bacteria in milk is very great, and I can hardly believe the figures which are indicated by my own experiments. I have found in milk which has been only two or three hours drawn from the cow as many as 20,000 to 40,000 to each teaspoonful of milk. These numbers are surprising, but they are not so large as have been found by certain German experimenters. In milk that has been standing for a little while they increase wonderfully, so that by the time the milk reaches the city their number is prodigious. I suppose no one in a city ever gets milk to drink that contains a smaller number of bacteria to the teaspoonful than there are inhabitants in the United States according to the last census.

We are now ready to pass to the third head of the subject, the prevention of the fermentations. As I stated at the outset, I have no royal prevention to recommend for this, and can hope only to throw out some suggestions which each may apply to its own special troubles. We may set aside the fermentations produced by rennet, and the alcoholic fermentations, because these are always produced by adding something to the milk, and may therefore be easily prevented.

Now, if all other fermentations are due to the growth of bacteria, we have only to keep them out of the milk in order to prevent them. This is, however, entirely impracticable. The bacteria are so abundant, and they lurk in so many places, that no practical method can be adopted to prevent them from getting into the milk. Especially is this true of the souring species. We find that the souring of milk is produced by a number of species of bacteria, and these are marvellously numerous about the barn, and more particularly in the dairy. Perhaps care may lessen their number, but it cannot do away with them altogether.

This is not true, however, with regard to the bacteria which produce what I have called the abnormal or unusual fermentations. The bacteria which produce slimy milk, bitter milk, blue milk,

etc., are not common in the dairy, and they may be kept out of the milk by using sufficient care. Their home is in filth, and they are usually troublesome because of uncleanness. Go to an ordinary cow shed and look at the conditions surrounding the cows. The cows are usually covered with filth, and are practically never clean. They wander at will through the day in swamps, or any muck that they may happen to find, and have every facility for dragging their teats through the mire, or they lie in the mud, and thus insure the fouling of the bag and teats. At night they have no choice except to lie in filth. The farmer goes to the milking in a condition frequently almost as dirty as the cow, and uses vessels which are never thoroughly cleaned. What better chance could there be for filth bacteria to grow? If there are any troublesome bacteria around, they will be sure to get into the milk in some way, and the wonder is not that milk sometimes undergoes troublesome fermentations, but that we ever succeed in getting milk fit to drink. These are usually the causes of the troubles that the farmer has with his milk.

I have in mind now a cheese factory which was at a certain season troubled with a badly-tainted milk, and this finally became so troublesome as to interfere with its business. A man with a pair of bright eyes was set to work to discover the cause of the trouble. He soon succeeded in tracing it to the milk of a single customer. If the milk brought by this man were kept away, the rest remained all right. Examining into the conditions of this patron's farm, he found that the cows were in the habit of wandering through a slimy swamp, and that the material from the swamp would get into their hair and teats, and hence in the milk. This was the sole cause of the trouble, for as soon as the cause was removed, the milk was good again.

I repeat, then, that the abnormal fermentations of milk can be prevented by using sufficient care. The time is coming when the farmer will be ashamed to own that he is troubled with slimy or bitter milk, for it will be regarded as indicating a lack of sufficient care and cleanliness in the arrangements of his barn. Keep your cow sheds clean, clean the cows themselves, give them clean beds to lie on, wash their teats, sand the floor, let a little of the first milk that runs out of the teat fall to the floor instead of into the milk vessel. If you want to convince yourself of the value of this last procedure, try the experiment of letting the first milk run into a separate vessel, and then see how much sooner it will sour than the rest. The first milk that comes out partly washes the milk duct, and hence contains the bacteria in great numbers. Clean your hands before you milk, and, above all, exercise more care in cleaning the vessels in which you milk. These cannot be sufficiently cleaned by a simple short scalding with hot water. Boil them once in a while for a long time on the stove, and you will find the time well spent.

These, then, are the remedies for all of the unusual fermentations, and every one must apply them for himself. It is impossible to tell beforehand where the trouble lies in your special case. It may be in the condition of the cow, or in the condition of the food, or the milker, or in the dairy itself; but, if you only look carefully for it, you will always find the mischief lies somewhere, and can be avoided by the exercise of sufficient care.

It is as important to make a careful toilet for the milking shed as for the supper table. Indeed, is it not more so? At the table a little dirt will produce no special trouble, but in the milking yard it may entail much trouble on yourself, and all using your milk in any form.

All of this will not, however, prevent the ordinary souring of milk. In spite of the greatest care, the bacteria which cause the lactic fermentation will get into the milk, and there is no practical way of avoiding them. Is there, then, any way by which the souring of milk may be prevented?

We may first ask if we cannot kill the bacteria after they get into the milk, for if this can be done, of course the milk will not sour. The simplest suggestion is to find some chemical which will kill them. It is easy enough to find such a chemical. Corrosive sublimate will poison them, and will also poison any one who may subsequently drink the milk. Of course such a violent poison will not answer. It is necessary to find something that will poison the bacteria and at the same time be harmless to man. One of the first substances ever used for this purpose was horse-radish. More than fifty years ago it was stated that horse-radish would prevent milk from souring. But when we drink milk we want it to taste like milk, and not like horse-radish. The poison used for preserving milk must, then, not give a taste of its own to the milk.

Within the last few years several chemicals have been tried for this purpose with some little success. Those most used are carbonate of soda, borax, boracic acid, salicylic acid, quick-lime, and some others not so common. In regard to these, we may summarize the results of recent experiments briefly as follows: Salicylic acid is of the most use in delaying the souring of milk. It can be used in proportions of 1–1000, about a teaspoonful to a gallon of milk. Borax comes next in value. It may be used in proportions of 8–1000, about three spoonfuls to a gallon. When used in these proportions, the two preservatives mentioned will assist the milk in keeping sweet for a short time longer than if they were not used. None of the others seem to be of any value, or at least of not enough to make it worth while to use them. Most of the preservatives sold in the market to-day are some compounds of these chemicals, and it is just as well for the farmer to buy the borax or salicylic acid pure, as to buy the patent mixture, and pay the price of the patent. At best, however, the use of chemicals for preserving milk is very limited, and it is not recommended to-day by any who have made a study of the fermentation of milk.

The method of milk preservation most commonly in use is that of heat. It is well known that high heat will kill all living things, and, of course, if milk be heated hot enough, the bacteria in it will be destroyed. It is found, however, that a temperature of boiling is not sufficient to kill all of the bacteria in milk. The bacteria in milk are in two different conditions. Some of them are active, perhaps swimming around in the milk, and are always rapidly growing. Others are in a dormant condition, which is known as a condition of spores. The spores correspond in a measure to seeds, and although they are dormant, each one has in itself the power to germinate and produce anew the active form of bacteria. Now it is found, that, while the temperature of boiling will kill all of the active forms, it will not kill the spores. To kill these by heat, the milk must be heated under pressure, since this renders it possible to obtain a higher temperature. A temperature of 230° F. will destroy these spores, and render the milk absolutely without life, absolutely sterile. Such milk will keep indefinitely without souring or undergoing other fermentation.

Of course it is not an easy matter to heat milk under pressure, and some other method of accomplishing the same purpose is desirable. It is found that a long continued boiling at the ordinary pressure of the air will sterilize the milk. It is also found that sterilization may be accomplished by what is called discontinuous heating. This is simply heating the milk to a temperature of boiling for a short time on several successive days. If milk be placed in a bottle and boiled a few minutes upon three successive days, it will be sterilized and remain subsequently without bacteria growth.

Based upon these facts regarding sterilization, a large number of forms of apparatus have been invented for conveniently accomplishing the heating. Several sterilizers of milk are on our markets, and still others in Europe. One of the simplest methods of sterilization is within the reach of every one. Place some milk in bottles with long necks and plug the neck with a wad of cotton wool. Then place the bottles in a common steamer, with which almost every house is provided, and steam the milk for an hour. This may not absolutely sterilize the milk, for a very few bacteria in the form of spores may be left alive. But it will so nearly accomplish the purpose that the milk will keep perfectly sweet for many days, and may be carried on a journey with impunity, provided the cotton plug is not removed. If desirable, a common cork can be put in the bottle on top of the cotton plug, to prevent the spilling of the milk.

The use of sterilized milk is rapidly becoming common. A few years ago no one ever heard of it, but now, especially in the cities, where it is impossible to get fresh milk, its use is growing rapidly. In the case of sickness affecting the digestive organs, doctors are

learning to recommend that all milk should be sterilized. Indeed, doctors have for a long time been accustomed to recommend boiled milk to patients, but formerly from a mistaken idea. It was always supposed that boiling the milk rendered it more digestible, just as cooking other food makes it more easy to digest. Within recent times, however, we have learned that boiled milk is not more easily digested than fresh milk, but, on the contrary, that it is far less easily digested. If an animal is fed with a certain quantity of boiled milk, and subsequently with an equal quantity of fresh milk, he will digest and absorb only about two-thirds as much of the boiled milk as of the fresh milk. The reason that boiled milk is better than unboiled milk for invalids is because of the presence of bacteria in the latter. In our cities, as we have seen, these are extremely abundant in all milk; and although to the ordinary healthy person they are harmless, they may be a source of irritation to one whose digestive organs are out of order, and therefore in an irritable condition. It is believed that nearly all of the cases of cholera infantum in our cities are due to the bacteria present in the milk drunk by infants. Nursing children are much less liable to have the disease, since they obtain their milk fresh and free from bacteria. It is not surprising that the doctors in our cities are learning that one of the first things to do in the case of intestinal diseases is to prevent the patient from taking in the large quantities of bacteria which he would swallow with unsterilized milk. I know of one doctor who goes further, and furnishes his patients with sterilized milk in order that he may be sure they obtain it.

There are two disadvantages in sterilizing milk by boiling. The first is that the milk is not thereby completely sterilized, and is likely to undergo some fermentation after a time. This is not a very serious matter, however, for the milk thus sterilized is pretty sure to be used before any of these fermentations occur. Milk that is sterilized is not usually intended for long preservation, but for using immediately, or, at least, within a few days. This being the case, it is not a matter of much importance if some of the spores of the resisting bacteria should be left in it in condition to set up a fermentation after a week or more.

The other disadvantage is a more serious one. The milk thus sterilized has not the taste of fresh milk. Every one is acquainted with the taste of boiled milk, and we all know that it is not so pleasant as that of fresh milk. To some it is quite disagreeable, and children frequently will not touch it. Now, any sort of sterilization by boiling is sure to cause the milk to acquire this taste of boiled milk. This taste appears at about the temperature of 160° F., and, since all methods of sterilization by heat raise the temperature much above that point, the taste of boiled milk is always found accompanying such sterilization.

Now, there is a method of sterilizing milk which avoids the production of this taste, but it is long and tedious. If the milk be heated to a temperature of 155° F. for twenty minutes upon six successive days it is commonly found to be sterilized, and, since it has not been heated to 160°, its original taste will be preserved. Such a process is, of course, too long to be of any practical value, except for scientific experiment.

The fact is, that with our present knowledge, there has been devised no way of sterilizing milk without either producing the disagreeable taste of boiled milk, or being so long about the process as to render it of no value in practice.

It is, however, possible to produce, with ease, a partial sterilization. It is frequently of great value to one dealing with milk to delay the souring as long as possible, and if this fermentation can be put off for a few hours even, it may prove of great use. There has been invented in Paris a method of treating milk which accomplishes just this. It is known by the name of pasteurization. It consists simply in heating the milk for a few minutes to a temperature of about 155°, or a little higher, and then rapidly cooling it. The short heating does not indeed kill all the bacteria that are in the milk, but it does very much diminish their numbers. So much does this heating check the bacteria growth that it is found to delay the fermentation of milk from twenty-four to forty hours. Of course such a delay as this is of the greatest value in our cities. For accomplishing this pasteurization several machines have been invented, all of which enable a large amount of milk to be heated in a short time. In some the milk is caused to run over metal plates that are kept hot by steam; in others the milk is in a large vessel and the steam conducted into the vessel in a coil of pipes. All of them accomplish the same purpose, but not with equal facility.

There is one advantage arising from pasteurization which renders its practice even more valuable. It is found that nearly all, if not quite all, of the pathogenic disease germs which are likely to occur in milk, are killed by the pasteurization. It is well recognized to-day that some of our dangerous epidemics are transmitted from house to house by means of milk. Milk furnishes a good medium for their growth, and has every chance of becoming contaminated. In cities epidemics of typhoid have been repeatedly traced to the milk supply. Now, if pasteurization is sufficient to kill these disease germs, and if at the same time it delays the souring from twenty to forty hours, and if the milk thus treated retains the taste of fresh milk, and permits the cream to rise on it in the natural way, it is plain that pasteurization is a process which is highly to be recommended. It is not surprising that in Paris, and in some of the large cities of France and Germany, pasteurization of milk is becoming more and more common. In Paris it is a regular business, and pasteurized milk is sold at a trifle advance over the price of ordinary milk. People are beginning to prefer it, since it keeps so much better, and is so much safer, and withal has all of the good qualities of fresh milk. It has been suggested that pasteurization of milk in cities should be required by law. So far as I am aware the pasteurization of milk has not yet been introduced into America.

Lastly, a word in regard to the value of cold in delaying fermentation. Every one knows that milk will keep longer if it is kept cool, and it can be preserved almost indefinitely when frozen. But every one is not aware of the great value of a temporary cooling of milk. When milk is drawn from the cow it is at a high temperature, and is, indeed, at just the temperature at which the bacteria will grow the best. The bacteria which get into the milk during the milking, therefore, begin immediately to multiply with great rapidity. If, however, the milk be cooled to as low a temperature as possible, it will take several hours' exposure to the ordinary temperature of the air to bring it back again to the condition where the bacteria will grow so rapidly. Indeed, except in the very hottest summer weather, it will not again become so warm as when it left the cow, and hence will not again offer such a good chance for bacteria growth. It follows, then, that a cooling of the milk immediately after milking is of the greatest possible value in enhancing its keeping properties. Milkmen should remember that half an hour's cooling of the milk, or even less than that, immediately after milking, will save several hours in the souring time, and in hot summer weather this fact should be remembered as one of the best methods of assisting in supplying customers with good milk.

Allow me now to summarize the important points which have attracted our attention this afternoon:

1. The fermentations of milk are varied, although only a few are commonly recognized because the souring of milk usually obscures all other fermentations.

2. All of the fermentations except the fermentations of rennet are caused by micro-organisms getting into the milk after milking and growing there.

3. The micro-organisms are so abundant around the barn and dairy that they cannot be kept out of the milk by any amount of care.

4. The bacteria which produce the abnormal or unusual fermentations, like slimy milk, bitter milk, etc., are, however, not so common but that they may be prevented from entering the milk in sufficient quantities to produce serious trouble.

5. Filth is ordinarily their source, and cleanliness the means of avoiding them.

6. The souring of milk cannot be prevented even by the greatest cleanliness.

7. Salicylic acid in proportions of 1–1000 may be of some little value in delaying the souring, but its use is not to be recommended except in special cases.

8. Milk can be entirely deprived of bacteria by the exposure to

a temperature of fifteen to twenty degrees above boiling water, or by a long-continued boiling, or by a series of short boilings on successive days.

9. Such milk has the taste of boiled milk. This taste appears at about the temperature of 160° F. Hence has arisen the method of pasteurization of milk. By this method it is heated to a temperature of 155° F. for a short time, and then cooled. This greatly delays the fermentations, and also kills the pathogenic germs that may be present.

10. In our large cities the popularity of sterilized milk is rapidly increasing, especially in the case of milk given to patients troubled with diseases of the digestive organs.

11. A cooling of milk immediately after it is drawn from the cow is of the greatest assistance in delaying the fermentation, and is probably the most practical method which can be recommended according to the present state of our knowledge.

HEALTH MATTERS.

Sneezing One's Teeth Out.

THE report of the physician in charge of the Ningpo Missionary Hospital for the past year, says the *British and Colonial Druggist*, contains some interesting observations on tooth-drawing in China. Dr. Daly remarks that Chinese teeth are much more easily extracted than those of Europeans. The native dentists are said to possess a wonderful powder, which is rubbed on the gum over the affected tooth. After an interval of about five minutes the patient is told to sneeze, whereupon the tooth falls out. Dr. Daly has offered a reward of $100 to any one performing the operation in this way in his presence, on condition that he is allowed to choose the tooth and examine the mouth before and afterward. So far no one will consent to perform the operation on these conditions.

Alcohol and Digestion.

From experiments made on himself by Dr. Eichenberg, says the *Medical and Surgical Reporter*, some further knowledge of the effect of alcohol on digestion is obtained, which contrasts strongly with the teetotal lecturer's experiment showing how digestion in a glass vessel is retarded by alcohol. Dr. Eichenberg found that a small dose of strong alcohol — e.g., brandy — shortens the time that food in general, whether animal or vegetable, or a mixture, remains in the stomach by more than half an hour. A similar but not quite so marked an effect is produced by a dose of diluted hydrochloric acid or mustard. Pepper and condurango diminish the time the food remains in the stomach by about a quarter of an hour. Beer and an infusion of rhubarb had no effect.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

American and European Meteorology.

FROM time to time discussions have appeared in foreign journals comparing weather conditions and laws of storms in Europe with those in America. These have often shown a remarkable difference between the results announced abroad and those found in this country, and it has been a matter of great difficulty to determine the exact cause of the discrepancies. In the matter of the recent animated discussion as to the temperature at some height in the atmosphere in high areas and storms, it has been suggested already that most of the differences are due to the fact that in Europe the ordinary paths of storms are far to the north-west, over Iceland; and in consequence none of the conditions experienced in this country, on the passage of a storm over a mountain, could be studied in the south-east quadrant of storms in Europe (see this journal, June 6, 1890, p. 346). A very interesting illustration of this point has just appeared in *Meteorologische Zeitschrift* for April. Dr. Hann reviews a paper by Professor Russel, "Prediction of Cold-Waves," originally published in the *American Journal of Science* for December, 1890, and closes with the following words:—

"Of the fact, that the principal cause of cold in winter is local heat-radiation at the earth's surface, the author has no foreboding (*Ahnung:* there seems to be no exact English equivalent), which indeed can scarcely be believed, since his own discussion sets it forth with such certainty. This discussion has only a negative value in that it shows how one, in setting up a rational system of weather forecasting, should not go too far in its seeming certainties." It is not my purpose, nor is it necessary, to defend Professor Russel in his position; but Dr. Hann's view is founded on so faulty a process of reasoning from known conditions in Europe to those which are supposed to exist in this country, that it should not be allowed to pass without comment.

I have already given in this journal (Feb. 27, 1891, p. 121) a statement of the conditions accompanying cold-waves in this country, and it seemed wise to make a partial study of cold-waves in Europe. To this end I first selected out all the cases during December, January, February, and March, in the years 1881–89, which showed a fall of 10° C. (18° F.) in twenty-four hours at Vienna, Austria. It should be noted that the cold-wave discussed by Professor Russel was a fall of at least 20° F. in twenty-four hours, and a temperature reaching 36° or below over an area of at least 50,000 square miles. Dr. Hann says he does not understand this 36°, and suggests that it may mean 36° below zero! This is most extraordinary, and shows how extremely deficient is the knowledge on this subject in this case. No cold-wave of this character has occurred in this country in the last ten years. Dr. Hann probably has in mind the cold of a Siberian winter, where temperatures of —70° are often experienced. The following comprise all the temperature-falls of 18° F. at Vienna: (1) Jan. 14, 1881, from 25° F. to 7°; (2) Dec. 29, 1882, from 48° to 30°; (3) Jan. 31, 1884, from 50° to 32°; (4) Feb. 28, 1886, from 26° to 7°; (5) March 3, 1888, from 33° to 15°; (6) Feb. 12, 1889. On examining the weather-maps for these dates, it was very quickly found that there is absolutely no comparison between the temperature-falls in Europe and those in this country. In most of the six cases there was a high area to the south, and almost a calm; the conditions were favorable for radiation from the earth; but in no single case was there a cold-wave. In (4) there was a high area to the north; but here only one other station, out of fifty-eight all over Europe, reported a fall of 18° F. In not one of these cases was there a fall of temperature over a large region, but it was almost entirely confined to single localities in a very large region, and was manifestly due, as Dr. Hann suggests, to radiation from the earth. In this connection it will be an interesting contrast to give a summary of cold-waves in this country found by Professor Russel between the years 1880 and 1889, statistics of which have been published in the "Annual Report of the Chief Signal Officer for 1891." The total number counted is 619, or an average of 62 in each year. Five of these cold-waves had a fall of 20° F., extending over a region more than 1,000,000 square miles in extent, and in eighty-seven cases the same fall occurred over more than 500,000 square miles.

It is well known that our cold-waves are due to the rather rapid passage across the country of a storm which is followed by a high area. Wherever the cold air may come from, only a very small proportion of it is due to heat-radiation, the principal cause suggested by Dr. Hann. It seemed advisable to study the storms and high areas passing over Europe. I took out all the cases in which these conditions were near Sonnblick during all the months 1887–89. There were fourteen storms and twenty-six high areas. Of these, only one storm, on Oct. 22, 1889, had any thing like the characteristics of storms in this country. In all the three years there was not a single high area that was similar to those experienced here. The evidence furnished by this study was most remarkable, and showed that no comparison whatever can be instituted between these conditions and their accompaniments in the two countries.

In 1884 there was established a high-level observatory at Ben Nevis, in Scotland, over 4,000 feet in height. A great deal has been expected from this observatory, lying as it does almost in the pathway of depressions unheard of in any other part of the

world, reaching as low as 27.4 inches. The observations for four years, 1884 to 1887, have just reached this country. During the four years sixty-eight storms and twenty-four high-areas have crossed over or very near the summit. As far as studied, the results have shown very materially different conditions here from those at Mount Washington. This is due in part to the lowness of the mountain, and in part to the proximity of the ocean on the west or on the side from which the storms advance. A comparison between Mount Washington and Ben Nevis shows, if any thing, that temperature and moisture have little or nothing to do with the generation of storms. At Ben Nevis the most extraordinary depressions are accompanied by only the slightest change in temperature, while at Mount Washington most remarkable changes in temperature are accompanied by much smaller changes in pressure. These facts would seem to show the extreme need there is of confining ourselves to the certainties of our own studies and conditions, and also the absolute impossibility of making and comparing any except the very broadest generalizations regarding weather conditions in Europe and America. H. A. HAZEN.

Washington, D.C., May 8.

Flying-Machines.

THE communication from Mr. H. A. Hazen in the issue of *Science* for May 1, and his quotation from Le Conte, already familiar, I presume, to many readers, suggests the following "deadly parallel:" —

(1) We cannot devise a method of utilizing fuel or a source of energy that shall equal the bird (land-animal, or fish).

(2) We can never build a machine which shall be as perfectly adapted to its purpose of self-transportation as the bird (the land-animal or the fish).

(3) There is a limit of weight, say fifty pounds, beyond which the bird cannot fly (one at which the animal cannot run, the fish live and swim).

Ergo, we can never build a flying-machine to carry a man [a railway train to excel the trotter at a mile in two minutes, the whale of a hundred feet length, swimming fifteen miles an hour].

Remembering what the first century of the operation of man's unimpeded inventive power has accomplished, with steam, with electricity, and with the infancy of his machinery, may it not be just as well to cease the attempt to define the impossible? T.

AMONG THE PUBLISHERS.

A QUESTION that has often been discussed is, whether it would be possible to produce rain at will by the use of explosives. It has been claimed by some that rain has followed cannonading, and to test the matter experimentally the latest Congress appropriated

Publications received at Editor's Office, May 4-9.

FISKE, A. K. Beyond the Bourn: Reports of a Traveller returned from "The Undiscovered Country." New York, Fords, Howard, & Hulbert. 222 p. 16°. $1.

FLOWER, W. H., and LYDEKKER, R. An Introduction to the Study of Mammals Living and Extinct. London, Black. 763 p. 8°. (New York, Macmillan, $6.)

HANS ANDERSEN'S Stories. Newly translated. In two parts. Part II. (Riverside Literature Series, No. 50.) Boston and New York, Houghton, Mifflin, & Co. 205 p. 16°. 15 cents.

HORSFORD, E. N. The Defences of Norumbega: A Letter to Judge Daly. Boston and New York, Houghton, Mifflin, & Co. 84 p. f°.

MACFARLANE, A. Principles of the Algebra of Logic. Edinburgh, David Douglas, 1879. 155 p. 12°. (Boston, Ginn, $1.35.)

WATSON, L. H. Not to the Swift. A Tale of Two Continents. New York, Welch, Fracker Company. 399 p. 12°. $1.25.

WESTERN Bookseller and Newsdealer, The. Vol. I. No. 1 *e. o. w.* Chicago, Western Bookseller. 40 p. 8°. $1 per year.

two thousand dollars. Many of the arguments in favor of the scheme can be found in "War and Weather," a book published by the author, Edward Powers, Delavan, Wis. Of the contents, we may mention "Evidence that Artillery Firing sets in operation certain Motions and Forces that cause Condensation of Aqueous Vapor, thus bringing Rain," "Objections and Criticisms Answered," and "Estimate of the Cost of producing a Rain-Storm."

— Macmillan & Co. have published a cheap edition, limited to ten thousand copies, of Mr. Bryce's great work on "The American Commonwealth." This author's edition is complete in every respect. The public is warned against the purchase of unauthorized reprints of this work which are incomplete and omit the American copyright matter, which forms a part of the book absolutely essential to its value and interest.

— *Our Language* "is designed to be a help for those who wish to increase their knowledge of the English language. It wil serve az a channel for conveying information contributed by leading scholars in this field to those eager to receive it, and az a medium of communication through which students of English may obtain one another's aid in deciding questions of etymology, the use of words, spelling, pronunciation, etc.," which is as clear as the statement found in the first number that "Charley Chu, a New York laundryman, haz this line of Celestial English on hiz hand-bilz: 'If eni article not being proper done up, then we wil do them over free by returning them.'"

— From Macmillan & Co. we have received "Elementary Lessons in Heat, Light, and Sound," by D. E. Jones, professor of physics in the University College of Wales. The lessons are intended to serve the purpose of introducing beginners to the study of experimental physics, and besides providing a certain amount of useful information, they also give an idea of the methods by which this information can be most directly obtained. For this reason the course has been made experimental, and such brief instructions are given as are required for making or using the necessary apparatus and carrying out the experiments.

SCIENCE

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PROTECTION FROM LIGHTNING.

THE NEW METHOD STANDS UNCRITICISED.

"The main point which I would urge upon your consideration is that by giving the electrical energy something which experience shows it will readily dissipate, that is, a conductor of varying resistance and small size, we can but mitigate the effects of lightning-discharges, so long as the conservation of energy holds true. I will only repeat that I have so far found no case on record where the dissipation of such a conductor has failed to protect the building under the conditions already explained."—*From paper read before the American Institute of Electrical Engineers, April* 21.

PRESS COMMENTS:

"If the theory advanced by Mr. N. D. C. Hodges, as to the cause of the damage and destruction of buildings when struck by lightning, and the method proposed to avert such damage is correct, that gentleman's discovery will properly rank as one of the most scientific and useful in the history of electricity. His reasoning seems to be correct, and it will be interesting to note the result of a practical test of his system of protecting buildings from damage by lightning. If he is right, then there will be no excuse for allowing property to go unprotected from lightning's destructive power. It is well to be prepared at all times for the unexpected, and lightning certainly possesses, more than anything else that we know of, a good deal of the element of uncertainty. It may, or may not strike one's property, and very frequently the lightning rods in vogue at the present time are no better than none at all. A reliable method of protection against damage to property by lightning is something very much desired, and if Mr. Hodges has discovered a means of accomplishing this result, his name will become intimately linked with that of the immortal Ben Franklin."—*Electrical Age, May* 2.

"The paper by Mr. N. D. C. Hodges, printed in this issue, on his new system of protection against lightning, adds some details to the description we gave of his ideas and methods two or three months ago. Mr. Hodges, having noticed that certain conditions and results attend a lightning stroke, has come to the conclusion that what is wanted is a protector that will dissipate the charge by means of its own dissipation. Such apparatus as he proposes would evidently be cheap, and there should be no difficulty in finding out whether the Hodges device is a protector that protects."—*Electrical Engineer, May* 6.

"As we understand it, the rod will consist of appropriately sized wire-pieces—which are to be fused or volatilized by the passage of the lightning; the energy being thus harmlessly converted. Undoubtedly there is room for improvement in the form of protector, conductor or discharger (or by whatever name we may call it) to be used in dealing with discharges of such high potentials as exist in lightning flashes. The really important part of this new invention is, that in its theory, it emphasizes the fact that the seat of the electrical energy is, and must be—not in the cloud or in the earth, just preceding a flash of lightning, but in the air column between cloud and earth."—*American Meteorological Journal, April.*

PROSPECTUS.

47 LAFAYETTE PLACE, NEW YORK, March 9, 1891.

It is proposed by the owners of letters patent dated Dec. 16, 1890, on an improved method for protecting buildings from lightning, etc., to organize a company for the handling of said patent and all improvements; and subscriptions are requested on the following terms and conditions:—

1. A company is to be organized with a capitalization of $10,000, in 1,000 shares of $10 each, fully paid in at par, the company to be organized in such State as the subscribers may determine by vote when all shares have been subscribed for, and with a charter to contain a provision that the amount of capitalization shall never be increased.

2. This $10,000 is to be used as working capital; and the object of the company will simply be to place licenses with responsible persons, corporations, or sub-companies, al such rates of royalty as may be agreed upon by a majority vote.

3. In lieu of any stock or cash payment to the inventor for his patent, the inventor will give said company the exclusive control of his said inventions in consideration of the payment to him by said company of one-third of the gross royalty receipts.

The officers of the company shall be elected by a majority vote of the stockholders without reserve. No stock shall be given to anybody for services or any thing else except actual cash payment at par into the treasury.

No subscriptions will be binding until the full number of 1,000 shares has been subscribed for.

Subscriptions are solicited in amounts from five shares upwards. The list opens with subscriptions for **one hundred and fifty** shares.

The names of those who have subscribed will be sent to any intending subscriber upon application.

N. D. C. HODGES.

Protection from Lightning

To dissipate the energy of a lightning discharge,—to prevent its doing harm,—it is necessary that something should be placed in its path upon which its energy (capacity for causing damage) may be expended. The Patent Lightning Dissipater is specially designed to serve this purpose, and will be sent prepaid, with full directions for its application, to any part of the United States on receipt of $5.00.

Correspondence solicited.

AGENTS WANTED.

N. D. C. HODGES,
47 Lafayette Place, N. Y.

BUSINESS OPPORTUNITY.

There is a good chance for the right man as Manager of the

LIGHTNING PROTECTION COMPANY,

which is being formed to operate under broad patents. The new method will certainly revolutionize the whole system of protecting property from lightning.

Those interested should send for report of the meeting of the American Institute of Electrical Engineers, held April 21.

Local companies are already forming to operate under licenses from the parent company, and we should be glad to hear from any who would care to consider entering this new field.

Correspondence is solicited with those desiring further information.

N. D. C. HODGES, 47 Lafayette Pl., N.Y.

CALENDAR OF SOCIETIES.

Anthropological Society, Washington.

May 5.—J. W. Powell, The Evolution of Industries; Thomas Wilson, The International Congress of Criminal Anthropology of Paris, 1889.

Biological Society, Washington.

May 16.—C. V. Riley, The Mexican "Arrow Weed" and "Jumping Bean"; J. M. Holzinger, Incentives to Natural History Work; William Palmer, The Distribution of Certain Mammals, Birds, and Plants on the Pribyloff Islands; George Vasey, Notes on Recent Field Work of the Botanical Division of the Department of Agriculture; F. A. Lucas, On a Tortoise from Duncan Island.

New York Academy of Sciences.

May 25.—Charles Lane Poor, The history of Lexell's comet from 1770 to 1890, illustrating the action of Jupiter and Saturn in drawing comets into the Solar System.

Boston Society of Natural History.

May 20.—W. O. Crosby, Geology of Hingham; G. H. Barton, Glacial Pot-hole at Pearl Hill, Fitchburg, Mass.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

AN experienced tutor, Latin, English, German, Science, wishes an engagement in High School or Academy for September commencing. H. L. M., 243 West 45th Street, New York City.

A GRADUATE of Yale College, now a medical student, who has made a specialty of the sciences, wishes employment during the summer vacation, from June 15th, to Oct. 1st, GEO. N. LAWSON, 22 College St., New Haven, Conn.

WANTED.—A permanent position that will pay $15 per week with prospect of advancement, by a young man (23) and college graduate of one year's experience. Address J. S. M., care of SCIENCE, 47 Lafayette Place, New York City.

WANTED.—Vols. I and II. of Allen's "Commercial Organic Analysis." SCIENCE BOOK AGENCY, 47 Lafayette Place, New York.

THERE is an opening in this office for a college graduate with scientific tastes. *Science*, 47 Lafayette Place, New York.

WANTED—A situation in an Analytical Laboratory during the summer vacation. Can give good references. Address M. ADGATE, North College, Burlington, Vt.

WANTED—A position in some College, Normal School or Academy to teach Biology, Physiology, Comparative Anatomy, Histology, Embryology or Botany. A graduate of the University of Wisconsin. Have had four years' experience as a teacher. Address "BIOLOGIST," care SCIENCE.

WANTED.—All of Vol. I. of *Journal of Analytical Chemistry*, published at Easton, Penn. State price and condition. SCIENCE BOOK AGENCY, 47 Lafayette Place, New York.

WANTED—A position in a Summer School of Gymnastics to teach any one or more of the following named physical exercises, viz.: Fencing (to ladies especially), Sparring, Club Swinging, Wands, Chest Weights and Free Movements. Am prepared to offer very favorable terms to any school desiring such work. WILLIAM FINDLAY, Proprietor of Phila. Inst. of Phys. Cult., 1009 Arch Street, Philadelphia, Pa.

A CHEMIST, taking P. G. work in the Scientific Department of one of our best colleges, would like to negotiate for some industrial position, where his knowledge would be of avail. Can furnish best of references. R. S. W., Box 691, Amherst, Mass.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

For sale, or exchange for geological works, the following works in anatomy, all latest editions: Allan, Tuain, Gray, Leidy, Massey, and Rollestin's Forms of Animal Life. S. W. Williston, Lawrence, Kan.

Will exchange a new Thomson reflecting astatic galvanometer, about 6,000 ohms, made by Clark, Muirhead & Co., London, and costing £30, with 1-9, 1-99, 1-999, shunts, lampand scale, for a Weston voltmeter and ammeter, or arge Wheatstone bridge, dial pattern, or a portable testing outfit. Address G. A., *Science* Office, 47 Lafayette Place, New York.

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

SCIENCE

NEW YORK, MAY 22, 1891.

THE TEACHING OF SCIENTIFIC METHOD.[1]

THE title of the address which I am privileged to deliver this evening has been advisedly chosen, in order to mark the contrast between the teaching of what is commonly called "science" and the teaching of "scientific method." It is, I think, to the failure to discriminate between these that the delay of which we so bitterly complain in introducing experimental studies into schools generally is large attributable.

For years past the educational world has been witness of conflicts innumerable. Its time-honored and most cherished dogmas and practices have been subjected to severely searching criticism, and it cannot be denied that they have oftentimes emerged from the battle in a terribly mangled condition; nevertheless they have hitherto manifested a marvellous recuperative power. Modern subjects, especially experimental science, have as yet barely obtained a foothold in our schools, and their educational effect has been scarcely appreciable; nay, it is even said, and probably with too much of truth, that the results under our present — may I not say — want of system are inferior to those obtained in the purely classical days of yore, when the scholars' efforts were less subdivided, when fewer subjects claimed their attention. The net upshot of discussion simply has been that we are intensely dissatisfied with our present position, and that we realize that some change has to be made. What that change is, we are not yet agreed. This, after all, is a very healthy state to be in, and one which necessarily must precede the construction of a satisfactory programme of studies suited to the vastly changed conditions under which the work of the world has been carried on since those two potent agents, steam and electricity, have assumed sway.

In setting our house in order, one great difficulty arises from the multitude of counsellors. Every subject in turn asserts its soul saving power, and puts forth its claim on a portion of the school time. An infinite number of suggestions are made. Who is to arbitrate in so difficult a case? Certainly, the more I study the educational problem, the more I realize the extraordinary difficulties which it presents. We are not all cast in one fixed mould, and cannot all be made alike. Educational rules must necessarily be made infinitely elastic, and educational success can only be achieved by the elastic administration of rules.

But are those who are charged with the conduct of so difficult a mission in any way specially prepared for the campaign? Suppose at a largely attended representative meeting of British teachers some one were to discourse in most eloquent terms of the beauties of the Chinese language, and were to affirm in the most positive manner possible that no other language offered the same opportunity of inculcating lessons of the highest import, what would be the result? Few, if any, present would know a word of the language; and therefore, although all might agree that they had listened to a most learned and interesting discourse, the effect would be ephemeral, and the advice given would be wholly disregarded by the majority. Never having had occasion to study the language, they probably would mentally set down the lecturer as a *doctrinaire*,— as a member of that troublesome and objectionable class, the enthusiasts, who are always interfering with other people's business and trying to lead them to mend their ways. Some few might think it politic to include Chinese in their school programme. These would either purchase a "Reader," and endeavor to master the subject themselves sufficiently to impress a smattering of information on a limited number of pupils in perhaps the higher forms in their schools, or would engage a young fellow fresh from the university as teacher, who had little more than mastered the principles of the Chinese alphabet, but was considered capable of any thing because he had taken a good degree. I very much fear that the treatment which I picture as accorded to my hypothetical subject, Chinese, is very much the kind of treatment meted out to experimental science in most schools. In the majority of cases it has been included in the programme because it has become fashionable and is a subject in which public examinations are held, more or less under compulsion, and without real belief in its worth or efficacy as an educational instrument. It is not surprising, therefore, that the results have been so unsatisfactory.

Two causes appear to me to operate in retarding educational progress. In the first place, our schools, with scarcely an exception, are controlled by our ancient universities; and these, I think, are not improperly described as, in the main, classical trades-unions. The majority of those who pass through their courses are required only to devote their attention to purely literary studies, and, unless by accident, they acquire no knowledge of the methods of natural science: consequently, having no understanding of, they exhibit no sympathy with, its aims and objects. It is a strange fact that so limited and non-natural a course of training should alone be spoken of conventionally as "culture," and that it should count as no sin to be blind to all that is going on in the world of nature around us, and to have no appreciation or understanding of the changes which constitute life, — no knowledge of the composition and characters of the materials of the earth on which we dwell. As the entire body of teachers in the more important of our schools are university men, and the examples which such schools set permeate into and pervade schools generally, the result of the introspective system of training followed at our universities is disastrous. That the effect of a change in the present university system on scholastic opinion and practice would be far-reaching, has been clearly realized. In proof of this, I may again cite remarks made by the present head master of Rugby, formerly head master of Clifton College, which I quoted in my address to the Chemical Section of the British Association at Aberdeen in 1885: they were made at a meeting of convocation at Oxford a few months previously. Dr. Percival said, "If twenty years ago this university had said, from this time forward the element of natural science shall take their place in responsions, side by side with the elements of

[1] Paper read by Professor Henry E. Armstrong at a meeting of the British College of Preceptors, April 8, 1891.

mathematics, and shall be equally obligatory, you would long ago have effected a revolution in school education." Reading between the lines, I imagine that Dr. Percival would imply that such action of the university would have led schools generally to pay attention to natural science, just as they do to mathematics, and that the general public would thereby also have been led to appreciate such studies. Charles Kingsley gave utterance to similar thoughts when he said, "I sometimes dream of a day when it will be considered necessary that every candidate for ordination should be required to have passed creditably in at least one branch of physical science, if it be only to teach him the method of sound scientific thought." Evidently Kingsley was of opinion that the teaching of his day was not always conducive to habits of "sound scientific thought." Has it been much improved in the interval? There are a few who cannot realize what would be the effect of neglecting to teach the elements of mathematics: Dr. Percival's advice that the elements of natural science should be made equally obligatory is therefore pregnant with meaning. All can imagine what difficulty would be created at Cambridge, for example, if those who went up wishing to study mathematics had no acquaintance with even the first four rules of arithmetic, but such is the position, owing to the neglect of natural science in schools, in which those of us find ourselves who are called on to teach science in colleges and at the universities; and the result is, that the time which should be devoted to the study of the higher branches of a subject is wasted in teaching elementary principles, more often than not, to unwilling minds unprepared to assimilate knowledge involving studies of an entirely novel character.

But, beyond the difficulties created by the low standard of scholastic and public opinion as regards natural science, there is a second retarding cause in operation, for the existence of which we teachers of natural science are in a great measure responsible, and which it behooves us to remove. I refer to the absence of any proper distinction between the teaching of what is commonly called "science" (i.e., facts pertaining to science) and the teaching of scientific method. The dates at which our various kings reigned, the battles they fought, and the names of their wives, are facts pertaining to history, and it is not so very long since such facts alone were taught as history. Nowadays such facts are but incidentals in a rational course of historical study, and it is clearly realized that the great object is to inculcate the use of such facts,— the moral lessons which they convey. "And if I can have convinced you that well-doing and ill-doing are rewarded and punished in this world, as well as in the world to come, I shall have done you more good than if I had crammed your minds with many dates and facts from modern history" (conclusion of Kingsley's lectures on America at Cambridge in 1862), are words which aptly convey an idea of one of the chief purposes gained in teaching history, and by which the methods of teaching it are being moulded. In like manner, to inculcate scientific habits of mind,— to teach scientific method,— we must teach the use of the facts pertaining to science, not the mere facts. Again, in teaching history in schools, we recognize that the subject must be broadly handled, and attention directed to the salient points which are of general application to human conduct: the study of minutiæ is left to the professed historian. But the very reverse of this practice has been followed, as a rule, in teaching natural science in schools. At various times during recent years — at the Educational Conference held at the Health Exhibition in 1884, and at the British Association meeting in 1885 — I have protested against the prevailing system of teaching chemistry, etc., to boys and girls at school as though the object were to train them all to be chemists; and I have also protested against the undue influence exercised by the specialist,— an influence which he has acquired in consequence of the inability of the head of the school to criticise and control his work. I refer here as much to the examiner as to the teacher; indeed, more. It appears to me to be our duty to regard all questions relating to school education from a general point of view, to consider what is most conducive to the general welfare of the scholar; and in allowing the specialist access to the school, the greatest care must be taken that the subject treated of is dealt with in a manner suited to the requirements of the scholars collectively. It is only in the case of technical classes that supreme control can be vested in the specialist.

In order that we may be in a position to usefully criticise the educational work which is being done, and the proposals brought forward, it is essential to arrive at a clear understanding of the objects to be achieved. Much of the work in a school is done with the object of cultivating certain arts (mechanical arts, we may almost call them),—the art of reading, the art of writing, and the art of working elementary mathematical problems, until the operations involved are efficiently performed in an automatic manner. An elementary acquaintance with these arts having once been gained, all later studies may be said to originate naturally in them, — both those which lead to the acquisition of knowledge, and those which have for their ultimate object the development and training of mental faculties. The character and extent of these later studies is subject to great variation, according as individual requirements, opportunities, and mental peculiarities vary; but the variation is not usually permitted to take place until a somewhat late period in the school career. We recognize, in fact, that in the case of every individual the endeavor must at least be made to develop the intellectual faculties coincidently in several directions. The question at issue at the present moment, I take it, is the number of main lines over which we can and are called on to travel. Hitherto only two have been generally recognized,— the line of literary studies, and the line of mathematical studies; but those of us who advocate the claims of natural science assert that there is a third, and that this is of great importance, as a large proportion of the work of the world is necessarily carried on over it. We assert, in fact, that however complete a course of literary and mathematical studies may be made, it is impossible by attention to these two branches of knowlege to educate one side of the human mind, — that side which has been instrumental in erecting the edifice of natural science, and in applying science to industry: the use of eyes and hands. I never tire of quoting from Kingsley's lecture to the boys at Wellington College (*Letters and Memories of his Life*, 3d abridged edition, p. 146, Kegan Paul & Co.): it puts the case into a nutshell: —

"The first thing for a boy to learn, after obedience and morality, is a habit of observation, — a habit of using his eyes. It matters little what you use them on, provided you do use them. They say knowledge is power, and so it is, but only the knowledge which you get by observation. Many a man is very learned in books, and has read for years and years, and yet he is useless. He knows *about* all sorts of things, but he can't *do* them. When you set him to work, he makes a mess of it. He is what you call a pedant, because he has not used his eyes and ears. . . . Now, I don't

mean to undervalue book-learning; . . . but the great use of a public school education to you is, not so much to teach you things as to teach you how to *learn*. . . . And what does the art of learning consist in? First and foremost in the art of observing; that is, the boy who uses his eyes best on his books, and *observes* the words and letters of his lesson most accurately and carefully, that is the boy who learns his lesson best, I presume. . . . Therefore I say that everything which helps a boy's powers of observation helps his power of learning; and I know from experience that nothing helps that so much as the study of the world about you."

Literary and mathematical studies are not a sufficient preparation in the great majority of cases for the work of the world: they develop introspective habit too exclusively. In future, boys and girls generally must not be confined to desk studies; they must not only learn a good deal about things, they must also be taught how to do things, and to this end must learn how others before them have done things by actually repeating — not by merely reading about — what others have done. We ask, in fact, that the use of eyes and hands in unravelling the meaning of the wondrous changes which are going on around us in the world of nature shall be taught systematically in schools generally; that is to say, that the endeavor shall be made to inculcate the habits of observing accurately, of experimenting exactly, of observing and experimenting with a clearly defined and logical purpose, and of logical reasoning from observation and the results of experimental inquiry. Scientific habits and method must be universally taught. We ask to be at once admitted to equal rights with the three R's: it is no question of an alternative subject. This cannot be too clearly stated, and the battle must be fought out on this issue within the next few years.

The importance of entering on the right course when the time comes that this claim is admitted — as it inevitably must be when the general public and those who direct our educational system realize its meaning — cannot be exaggerated. The use of eyes and hands — scientific method — cannot be taught by means of the blackboard and chalk, or even by experimental lectures and demonstrations alone: individual eyes and hands must be actually and persistently practised, and from the very earliest period in the school career. Such studies cannot be postponed until the technical college or university is reached: the faculties which can there receive their highest development must not have been allowed to atrophy through neglect during the years spent at school. This is a point of fundamental importance. At school the habit is acquired of learning lessons, of learning things from books; and after a time it is an easy operation to a boy or girl of fair mental capacity, given the necessary books, to learn what is known about a particular subject. One outcome of this, in my experience, particularly in the case of the more capable student, is the confusion of shadow with substance. "Why should I trouble to make all these experiments which take up so much time, which require so much care, and which yield a result so small in proportion to the labor expended, when I can gain the information by reading a page or so in such and such a text-book?" is the question I have often known put by highly capable students. They fail to realize the object in view,— that they are studying method; that their object should be to learn how to make use of text-book information by studying how such information has been gained; and to prepare themselves for the time when they will have exhausted the information at their disposal, and are unprovided with a text-book, when they will have to help themselves. I am satisfied that the one remedy for this acquired disease is to commence experimental studies at the very earliest possible moment, so that children may from the outset learn to acquire knowledge by their own efforts; to extend infantile practice — for it is admitted that the infant learns much by experimenting — and the kindergarten system into the school, so that experimenting and observing become habits. The vast majority of young children naturally like such work, and it is to be feared that our system of education is mainly responsible for the decay of the taste with advancing years.

No doubt, just as literary excellence may be attained through the agency of one or other of several languages, scientific method may be inculcated in a variety of ways; and we may expect that, looking at the problem from various points of view, teachers will ere long devise courses suited to the requirements of scholars of different types. My views have been somewhat fully set forth in the "Reports to the British Association of the Committee on the Present Methods of Teaching Chemistry" (B. A. Report, 1888, 1889, 1890); but it is perhaps not superfluous to mention that the draft schemes which I have prepared are but outlines for the consideration of the competent teacher. On the present occasion, I may fitly bring my address to a conclusion by calling attention to a few simple experiments in illustration of the method of teaching of which I am an advocate. [The remaining portion of the address was illustrated with experiments.]

In the first place, I hold that, in order that children may acquire scientific habits, they should be led to look around them and take note of the various objects which present themselves to view. Lists of such objects having been prepared, their several uses having been as far as possible realized, and much simple information as to their origin, etc., having been imparted by reading lessons and practical demonstrations, a stage will be reached at which the children can themselves begin to determine the properties of common objects, generally by measurement. The measurement lessons in the first instance may be of the simplest kind. Much may be done with the aid of a boxwood scale divided into tenths of an inch on the one edge, and into millimetres on the other. With the aid of such a scale, children may learn to measure accurately, and may be taught the use of decimals and the relation between the English and the metric system. Obviously such work might well form part of the arithmetic lesson, and there can be no doubt that "practical arithmetic" lessons would often be far more easily mastered and be more interesting than are the dry problems of the books. It is easy also to take advantage of the opportunity afforded by these lessons to impress useful information of quite another character by such an exercise as the following, for example, which I suggest, however, merely by way of illustration, and not as in any sense novel: "Third-class passengers usually pay fare at the rate of one penny per mile. Ascertain from a railway time-table (Bradshaw) the fares to a number of the chief towns in England, Wales, and Scotland from London, and then calculate the distances in miles and kilometres (1 kilometre is equal to 1,000 metres)."

In the next place, the measurement lessons may take the form of lessons in weighing. I am of opinion that the disciplinary effect of teaching children to weigh exactly cannot be overestimated. It matters little what is weighed, provided that the weighing be done as accurately as the balance at disposal permits. Professor Worthington, in his invalua-

ble book "Physical Laboratory Practice" (Rivington's), has advocated, the use of a simple balance costing only four shillings. However suitable this may be for demonstrating certain principles in physics, its use is to be entirely deprecated, in my opinion, for the purpose I have in view. I would urge most strongly that a far better instrument be procured, such as one of Becker's (of Rotterdam; English agents, Townson and Mercer) balances, costing, with suitable weights, about £3. In using such a balance, care has to be taken in releasing the beam and in bringing it to rest again; the pans must not be allowed to swing from side to side, but must be made to move gently up and down; the weights must be lifted on and off the pans with pincers, not touched by the fingers, so as to preserve them untarnished; and the weighing can, and in fact must, be made with considerable exactness. Finding that so many precautions have to be taken, and being severely reprimanded if careless in using such a balance, the child acquires a wholesome respect for the instrument, and soon becomes careful and exact. Weighing with the four-shilling pair of scales can afford no such discipline: their use in no way serves to correct the tendency (to quote a schoolboy phrase) to "muck about," unfortunately inherent in youth,— a tendency which can, I believe, be more successfully counteracted by proper measurement lessons than in any other way. The objection made to the purchase of so costly a balance for school use, I hold to be quite unwarrantable. Schools have no hesitation in charging for the use of books, and a charge of half a crown a year would more than cover their cost, if it were not possible to provide weighing appliances as part of the school furniture. I have been told that you cannot trust boys to use so delicate an instrument as that I advocate: and probably you cannot, if you wait until they have grown past control; but I believe that the difficulty will not arise if the instruction be given to children when quite young.

Having learned to measure and weigh exactly, the children may be set to examine things generally. One of the best exercises that can be devised consists in weighing and measuring rectangular blocks of different kinds of wood, and then reducing the results so as to ascertain the weights of equal bulks. In this way the child is led to realize that in the several varieties different amounts of the wood-stuff are packed in the same space; that some woods are denser than others. The relative densities may then be calculated, taking the lightest as standard; and also their densities, i.e., the quantity of wood-stuff in the unit of volume, choosing several different units both of mass and of volume. The data thus obtained may be made use of in many ways, e.g., in setting arithmetical problems as to the weights of planks, etc., of various sizes; and lessons may at the same time be given as to the uses and characters of the different woods, the trees from which they are obtained, etc. In a similar manner, common liquids may be studied comparatively with the aid of a simple "density" bottle, constructed by filing a nick down the glass stopper of an ordinary two ounce narrow-mouth bottle, which may also be used in determining the relative density of solids of irregular shape. Children are thus put in possession through their own efforts of a series of numerical data whereby various materials may be characterized, and can be led to realize that it is possible to convey exact information by quoting these numerical data.

It is almost superfluous to point out that when the use of the balance has been learned, a stage is reached at which the study of levers and other simple mechanical powers may very properly begin; and that the determinations of densities of liquids serve as an appropriate introduction to hydrostatics.

Measurements of another kind, which afford most valuable training, are those effected with the aid of a thermometer. It is most important that the use of this instrument should be generally understood, especially by women. It is astonishing how few people know the temperature at which water boils, and how mysterious an instrument to most is the clinical thermometer. Practice having thus been acquired in making measurements, and considerable knowledge having been gained of properties of common materials, I would advocate the quantitative study, especially by girls, of the effect of heat on vegetable and animal food materials, and subsequently on earthy substances and metals. Such exercises would serve as an appropriate introduction to the study of chemical change, which at this stage should be entered on more particularly with the object of developing the reasoning powers. I propose to give two examples by way of illustration. The one relates to the discovery of the composition of air; the other, to the discovery of the composition of chalk.

In considering air, it is the practice with most teachers, I believe, to explain, and in some cases demonstrate, how oxygen may be prepared, and how brilliantly many substances burn in it; air is then stated to be a mixture of oxygen with nitrogen in certain proportions, and certain proofs of this statement are advanced. Although much interested in the statements, and delighted at witnessing the firework displays which attend combustion in oxygen, the young student is not much the wiser for such lessons: a certain amount of "prepared food" has been put into his or her mouth, but no understanding acquired as to how it has been prepared, or whence it came. I advocate an entirely different course: I would not say one word as to what air is, or as to its having any thing to do with combustion, but would lead the scholar to discover that air is concerned in many common changes which apparently occur spontaneously, and to understand how the discovery that this is the case is made. Having directed attention to the manner in which animal and vegetable substances gradually decay, and are destroyed when burned, and to the rusting of iron, etc., I would propose that such changes should be experimentally investigated, and suggest that as iron rusts so readily when moist, the rusting of iron should be first examined: then would come the question, "But how is this to be done?" Having become so habituated to the use of the balance, and to express facts by numerical data, the student would appreciate the advice, "Let us see whether the balance will not aid us; let us endeavor to ascertain whether the iron gains or loses in weight during rusting." A clock-glass or saucer is therefore weighed; some iron borings or nails are put upon it, and the weight ascertained; and, as iron is known to rust more rapidly when wet, the borings or nails are wetted and set aside to rust. After several days, the rusted iron is dried in an oven and weighed: it is found that the weight has increased, whence it follows that something from somewhere has been added to the iron. Thus a clew has been gained, and, following the example of the detective in search of a criminal, this clew is at once followed up. "Where did the something come from? It might be the water; but is there no other possible 'offender'? Yes, the iron rusted in air." This suggests the experiment of exposing wet iron in air in such a way as to ascertain whether the air is concerned in the rusting. Some borings are tied up in a piece of muslin, and the bag is hung from one end of a piece of stout wire,

bent round at the opposite end, so as to form a foot; the wire is set upright in a dish full of water, and a large pickle-jar is inverted over it, with its mouth in the water. The iron is thus shut up over water along with air. Gradually the iron rusts, and concurrently the water rises in the jar, showing that the air is concerned, as no rise is observed in a comparison experiment without the iron. But after a time the water ceases to rise: measurement shows that only about one-fifth of the air disappears. Clearly, therefore, the air is concerned. The experiment is repeated, and the same result obtained; fresh iron is put into the residual air, and still no change results: hence it follows, that, although the air plays a part in the rusting of iron, the air as a whole is not active, but only one-fifth part of it, which serves to suggest that the air is not uniform, but has parts. Consider the importance of the lesson thus learned, the number of discoveries made by a few simple quantitative experiments, the insight into exact method which is gained by a thoughtful worker.

To pass to my second example, — the discovery of the composition of chalk. How is this to be effected? I would call attention to what is known about chalk by people generally, — what it is like, where it occurs, and what it is used for, — and ask whether there is no well-known fact connected with chalk which will serve as a clew, and enable us to apply our detectives' method. One of the great uses of chalk is for making lime, which is got by burning chalk. Is there any thing known about lime which shows that it differs from chalk? Yes, when wetted, it slakes and much heat is given out, while chalk is not altered by wetting; when the experiment is made quantitatively, lime is found to increase about 33 per cent in weight on slaking. Let us then study the conversion of chalk into lime by burning, and, as our unaided eyes tell us nothing, let us call in the aid of a balance. A weighed quantity of chalk is strongly heated, and is found to grow lighter; after a time, no further loss is observed, and, when this is the case, the loss amounts to, say, about 43 per cent; on repeating the experiment, the same result is always obtained, and therefore it cannot be an accident that the loss amounts to only about 43 out of every 100 parts of chalk. What conclusion are we to draw? Evidently that the stuff composing chalk consists of lime-stuff plus something else which is driven off when the chalk is burned. What is this something? Can't we catch it as it is given off? (We can, but the experiment is difficult, requiring special appliances, owing to the high temperature required to burn chalk in a close vessel). If not, is there no other clew which can be followed? Yes, there is. It is to be supposed that at an earlier stage in the experiments, attention will have been directed to the way in which discoveries were made in early times; to the fact that various substances were found to act upon each other, giving new substances; and that when a new substance was discovered its action on the previously known substances was studied; that in this way various acids were discovered; and that it was found out that these were powerful solvents of metals, earthy substances, etc., of chalk, among other substances. What happens to chalk when thus dissolved in an acid? The experiment is tried, and it is found that an air-like substance or gas escapes as the chalk dissolves. How does lime behave with acid? It is found on trial to dissolve, but no gas is given off. May it not be, then, that the gas which is given off when chalk becomes lime is also given off when chalk is acted on by acid? Let us find out how much gas is given off in this latter case. A weighed quantity of chalk is dissolved in acid and the gas measured, a simple apparatus being used, like that figured in the last "British Association Report" (*Nature*, April 23, 1891). It is found, when several experiments are made, that, on the average, about 22,000 cubic centimetres of gas are given off per 100 grams of chalk; and chalk is thus shown to be characterized not only by the percentage of lime which it yields, but also by the amount of gas which it affords when dissolved in acid.

What is the weight of the gas that escapes? The experiment is carried out (by means of a very simple apparatus), and the all-important discovery is made that the weight of the escaping gas is just about what was lost on burning chalk. There can be little doubt, therefore, that the gas thus studied is "the something" which is given off when chalk is burned. If so, perhaps it may be possible to re-associate this gas with lime, and produce chalk. Lime is therefore exposed in an atmosphere of the gas, and the increase in weight determined; it is eventually ascertained that the lime increases in weight to the extent required on the assumption that it is reconverted into chalk; and on examining the product it is found to behave as chalk both when heated and when dissolved in acid. Thus the problem is solved, and it is determined that chalk-stuff consists of lime-stuff and chalk-gas. I employ these terms advisedly, and advocate their use until a much later stage is reached, when systematic nomenclature can be advantageously made use of.

In talking about chalk, it may be pointed out that chalk is believed to consist of skeletal remains and shells of sea-animals; and, when the composition of chalk has been ascertained, the suggestion comes naturally to examine shells. When their behavior on burning and towards acid is studied quantitatively, results are obtained which place it beyond doubt that they essentially consist of chalk-stuff. The chalk studies thus become of very great importance, and may be made to cover a wide field.

It is not to be denied that there are difficulties connected with such teaching as that I am advocating, but it is a libel on the scholastic profession to assert that the difficulties are insuperable. I am sure that in this case the old ever-true saying may be quoted, "Where there's a will there's a way." Such teaching has not yet been given simply because there must be less class-teaching, more individual attention, an adequate proportion of the school time must be devoted to the work, and properly trained, sympathetic teachers must be called in to give such instruction.

When scientific method is taught in schools, there will inevitably be a great improvement in school-teaching generally; it will be carried on in a more scientific manner, and new methods will be introduced. Indeed, I have already learned from a head master in whose school experimental science-teaching is receiving much attention, that the leavening effect on the teachers of some other subjects in the school is quite remarkable, and that they are clearly being led to devise more practical modes of teac

Photography and the lantern, also, are modern weapons of great power, which often enable us to clothe the dry bones of otherwise unattractive subjects with pleasing drapery. And here the parent can often intervene with great effect.

[Prof. Armstrong, in conclusion, drew attention to several "logs" kept by young children, illustrated with photographs, and insisted on the educational value of such work, owing to the opportunity which it afforded of directing attention to various matters of interest, and of impressing useful information on the memory.]

NOTES AND NEWS.

MR. E. M. JOHNSON, a graduate of the State School of Mines at Rolla, has been appointed to a position as aide on the Missouri Geographical Survey.

— Mr. T. H. Cornish of Penzance has a note in the current number of the *Zoölogist*, according to *Nature*, on some remarkably large catches of fish on the Cornish coast. On March 18 last, 12,000 gray mullet (*Mugil capito*) were captured, by means of a draw seine, by the fishermen of Sennen Cove, at Whitsand Bay, Land's End. The fish were of fine quality, one being brought to Mr. Cornish which measured two feet in length, one foot three inches in girth, and weighed six pounds ten ounces. On the 31st of the same month a Lowestoft mackerel driver, fishing some leagues south-west of the Lizard, took 48,000 mackerel. No such catch of mackerel, for one night's fishing, had ever been heard of before at Penzance, and what makes it more extraordinary, says Mr. Cornish, is that it should have taken place in March, when the catches usually average a few hundreds only. Later on in the season, in the fishing west of Scilly, 20,000 to 25,000 is regarded as a heavy catch.

— The preliminary returns of the recent census operations in India, says *Nature*, show that the population in British territory is 220,400,000, as against 198,655,600 in the former census, an increase of nearly 22,000,000. The Feudatory States, omitting incomplete returns, which may be taken at about 90,000, have a population of 61,410,000, making a total of 281,900,000, as against 250,700,000 for the same areas at the last census. The returns give Bombay 806,000, Madras 449,000, Calcutta municipal area and port 674,000, and including the suburbs Howrah and Bally, 969,000. At the last census the total for the same area was 847,000. Calcutta municipal area shows an increase of 92,000, and Howrah and Bally an increase of 24,000. The returns from Burmah show that the population of the whole country, excluding the Shan States, is 7,507,068, or 48.8 persons to the square mile. The population of Lower Burmah alone is 4,526,432, or an increase of about 790,000 since 1881.

— The American Academy of Political and Social Science has just issued its first handbook, containing the Constitution, names of officers, report of the executive committee for the first year, and the list of members. Although in active service only twelve months, it now has a membership of 1,978 gathered from every State and Territory in the Union, and from ten foreign countries. The membership in the United States is widely scattered. California, for example, is represented by 25 members; Massachusetts, by 195; New York, by 200; Illinois, by 150; while Canada on the one hand, and our Gulf States on the other, have 20 and 40 respectively. There are over 50 members in England, besides several in Scotland and Ireland. France is represented by 4; Germany, by 16; Russia, Switzerland, Austria, Italy, and even Japan and India, contribute to the academy's membership. The varied character of the occupation of the members also testifies to the great interest which economic and political subjects are exciting at present in the public mind. Among the members are leading representatives of all professions and branches of business.

— The English Meteorological Council have just published an atlas of cyclone-tracks in the South Indian Ocean, from information collected by Dr. Meldrum of Mauritius, during a period of thirty-eight years, from 1848 to 1885 inclusive, with the exception of three years for which no reports of cyclones were received. According to *Nature*, the tracks are represented in two sets of charts, — one set showing the distribution in each year; and the other grouping the storms according to months, excepting for August and September, in which months no cyclones were recorded. In dealing with these cyclones, Dr. Meldrum has divided them into progressive and stationary. It is admitted, however, that some of the latter may have moved, but that their progress may not have been detected from lack of observations. The relative frequency of both classes of storms for the whole period is very small, varying from one in eighteen years for July, to five in three years during February and March; but, although the number of storms is so small, it does not appear likely that many have been missed, considering the untiring persistence with which Dr. Meldrum has pursued his investigations. The tracks of the several cyclones will afford much valuable information, and lead to a better knowledge of the latitude in which the recurvature of the storms in that ocean takes place. A cursory examination shows that the range of latitude over which the points of recurvature extend varies considerably, being from about 15° to 25° south.

— The trustees of the Indian Museum, Calcutta, have issued an interesting and instructive report, by Mr. E. C. Cotes, on the locust of north-western India (*Acridium peregrinum*). The report, as quoted in *Nature*, sums up the results of an investigation conducted in the entomological section of the museum. It seems to be established that most of the flights of this locust issue from the region of sand-hills in western Rajputana. Others, however, invade India from breeding-grounds which probably lie along the Suliman Range, or even, perhaps, in some cases, beyond India's western frontier, in the sandy deserts of Baluchistan, southern Afghanistan, and Persia, though reports received from these regions, Mr. Cotes says, are so fragmentary that no very definite conclusions can be formed from them.

— The Meteorological Department of the Government of India has published Part 3 of "Cyclone Memoirs," containing an elaborate discussion of the two most important storms in the Bay of Bengal during the year 1888,— viz., those of Sept. 13–20 and of Oct. 27–31,— and also of the cyclone in the Arabian Sea of Nov. 6–9, 1888, accompanied by tables of observations during and before the storms and by 29 plates. The following (*Nature*, April 30) is a very brief *résumé* of some of the more important conclusions arrived at by Mr. Eliot with regard to these storms, and with regard to cyclones generally in India: (1) that the difference of intensity in different quadrants is chiefly due to the fact that the humid winds which keep up the circulation enter mainly in one quadrant; (2) that the ascensional movement is usually most vigorous in the advancing quadrant, a little distance in front of the centre; (3) in consequence of this, and of rainfall taking place most vigorously in front of the cyclone, the isobars are oval in form, and the longest diameter coincides approximately with the direction of the path of the centre (this is not in the middle of the diameter, but at some distance behind); (4) that the cyclonic circulation cannot be resolved into the translation of a rotating disk or mass of air, and that its motion is somewhat analogous to the transmission of a wave; (5) that the direction of advance of these storms is mainly determined by rainfall distribution, and there is a marked tendency for storms to form in and run along the south-west monsoon trough of low pressure; (6) the lie of this trough depends upon the relative strengths and extension of the two currents.

— Among the contents of the current number of the *Journal of the Straits Branch of the Royal Asiatic Society*, as we learn from *Nature*, is a paper on the *Sphingidæ*, or hawk-moths, of Singapore, by Lieut. H. L. Kelsall, R.A.. Mr. H. N. Ridley contributes papers on the *Burmanniaceæ* of the Malay Peninsula; on the so-called tiger's milk, "Susu Rimau," of the Malays; and on the habits of the red ant, commonly called the *Caringa*. These ants, although very ferocious, are remarkably intelligent; and Mr. Ridley gives a striking account of the way in which they make leaf-nests. They have also great courage, and do not scruple to attack any insect, however large. Mr. Ridley once saw a fight between an army of *Caringas*, who tenanted the upper part of a fig-tree, and an advancing crowd of a much larger kind of black ants. The field of battle was a horizontal bough about five feet from the ground. The *Caringas*, standing alert on their tall legs, were arranged in masses, awaiting the onset of the enemy. The black ants charged singly at any isolated *Caringa*, and tried to bite it in two with their powerful jaws. If the attack was successful, the *Caringa* was borne off to the nest at the foot of the tree. The red ant, on the other hand, attempted always to seize the black ant and hold on to it, so that its formic acid might take effect in the body of its enemy. If it got a hold on the black ant, the latter soon succumbed, and was borne off to the nest in the top of the tree Eventually the *Caringas* retreated to their nest The last to go had lost one leg and the abdomen in the fight; nevertheless,

Mr. Ridley saw it alone charge and repulse three black ants one after the other before it left the field.

— The establishment of the Wharton School of Finance and Economy as a department of the University of Pennsylvania in 1881, marked an epoch in American higher education. Mr. Joseph Wharton, one of the most successful business-men of Philadelphia, believing most thoroughly in the desirability of a higher education for business-men, and seeing in the business world about him but few college-trained men, determined to see whether a course might not be arranged which would appeal to this class. With this end in view, he gave the University of Pennsylvania $100,000, on condition that it would establish and maintain a course in finance and economy for the benefit more especially of those youth who expect to enter business careers. The curriculum was made up of two parts, — a liberal and a practical. The latter consisted of accounting, mercantile laws and practice, the organization and management of various industries, etc. The former was made up of American history and politics, European history and politics, political and social science, statistics, etc. The liberal elements in the course attracted many young men who had no idea of going into business, but wished the thorough training in history and politics which this course afforded. As a result, the students of advanced classes, who expected later to study law or go into journalism, or to teach history and political science, chose this course by way of preference. The school is only ten years old, and consequently cannot point to its alumni by the hundreds or thousands; but the dinner given to Mr. Wharton by the alumni and their friends on May 19 in Philadelphia bore ample evidence of the success which the school has attained. The new curriculum has produced a visible effect already on other American colleges. The new university at Chicago proposes to have a college of practical affairs, which will be in essence a reproduction of the Wharton School; while the Stanford University, in California, will attempt an even more ambitious scheme along this line.

— In the improvements in contemplation at the University of Pennsylvania, the plans for which are now under way, two of the needs of the university which have lately made themselves strongly felt will be provided for. One is the necessity of improving the heating and ventilation of existing buildings and providing for that of new buildings. The other is the need of providing for the growing demands of the Department of Mechanical Engineering. Heretofore each building has been heated by a separate plant in its basement, and has been lighted by gas. It has been decided to build a central heating-station, with a present boiler capacity of 1,200 horse-power, from which to heat all the buildings, at present eleven in number. In addition, the buildings are to be lighted throughout by electricity, and to be thoroughly ventilated by the use of large ventilating fans in the basement, which are to be driven by steam or electric motors; while the ventilating flues in the old buildings are to be changed to accord with the best modern practice. The engines and dynamos for this purpose are to be placed on the ground floor of a separate building, the two upper floors of which will be used by the Mechanical Engineering Department. These two buildings are so designed that additions may be made to them as need arises. The entire plant is to be put in, not only for the purpose of furnishing light and heat in the most economical manner, but, in addition, it is designed especially for the purpose of instruction, for which it will at all times be available.

— The Kentucky Experiment Station is located at Lexington, in the heart of the blue-grass region, and on a soil which has been formed from the decomposition of the underlying limestone rocks. On this soil potash has seemed to be the most needed element of a fertilizer for corn and potatoes, although it has not produced so marked an effect on wheat. Bulletin No. 33 of this station reports a series of experiments in applying fertilizers to corn, of which the following is the station's summary: "The results obtained this year are almost identical with those of the last two years; that is, first, that, in those plots where potash was one of the ingredients of the fertilizers used, there was a marked increased yield, both in corn and fodder; second, that in plot 15, where a fertilizer was used without potash, there was scarcely any increase in yield over those plots containing no fertilizer; third, that the greatest increased yield was made by using a combination of potash and nitrogen; fourth, that the use of muriate of potash alone resulted in a marked increased yield over the plots containing no fertilizers; fifth, that there was a profit in the use of fertilizers in every instance where potash was one of the ingredients, the largest net profit arising from the use of the mixture of nitrate of sodium and muriate of potash; sixth, that there was a loss by the use of fertilizers where potash was not one of the ingredients; seventh, that so far, potash fertilizers have shown their effect the third season after application." The Ohio station has been conducting similar experiments to those reported above, both on its farm in Columbus and on several other farms in different parts of the State; but the results differ from those of Kentucky in that no combination of fertilizers has produced a sufficient increase of crop to pay for the cost of application. In only one place has potash produced any marked effect in Ohio, and that was in Butler County, on a soil that is probably largely derived from similar rocks to those which have formed the blue-grass soil.

— In his monthly report for April, Mr. Arthur Winslow, State Geologist of Missouri, states that field-work during that period had been actively resumed. Examinations of clays and structural materials had been made in Franklin, Montgomery, Audrain, Warren, and St. Charles Counties, and the experimental work on the clays had progressed well. Examinations of coal deposits had been extended into Clinton, Caldwell, Linn, Schuyler, Adair, Sullivan, and Boone Counties. Detailed mapping was begun in Ray and Madison Counties, and about fifty square miles have been covered. Bad weather and the water-soaked condition of the country had, however, interfered with the progress of this work. Examinations of mineral waters had been made in St. Louis, Jefferson, Perry, Madison, Wayne, Laclede, Howell, Oregon, and Barry Counties, and samples had been carefully collected for analysis. Work on the zinc and lead deposits of the southern portion of the State has been resumed by the United States Geological Survey in co-operation with the State Survey. About the middle of the month a party of the Coast and Geodetic Survey, in charge of Mr. Isaac Winston, began the work of extending a line of precise levelling from Jefferson City westwards. This line was brought as far as Jefferson City several years ago, and is now extended in accordance with an application made by the State Survey to the superintendent of the Geodetic Survey. In the preparation of the report on the paleontology of the State good progress has been made, and several other reports are in course of preparation.

— A committee of the Appalachian Mountain Club has made arrangements for the free exhibition of the geographical collection of the Brooklyn Institute in Boston. The Winslow Skating-Rink has been secured for the exhibition for three weeks, May 11 to May 30. The collection includes all varieties of geographical appliances, chiefly for educational purposes, such as wall-maps, atlases, globes, models, views, diagrams, text-books, etc. It is comparable to the collection made by the Royal Geographical Society, and exhibited in London a few years ago. The materials have been given to the institute by all the leading publishers in this country and Europe. The collection was on free exhibition in Brooklyn during March, and was visited by about 30,000 persons, including many teachers with their classes. It is designed for exhibition in various cities before final incorporation in the museum of the Brooklyn Institute. The University Extension Society of Philadelphia, the Johns Hopkins University of Baltimore, and the National Geographic Society of Washington, are in correspondence with the institute with the intention of securing the collection in their respective cities. The collection has been carefully examined, and is deemed well worthy of attention from those interested in general education. It will be found suggestive to teachers from the large variety of materials that it includes; it will promote an interest in the study of geography among the pupils in our schools; it will prove of value to superintendents and principals of schools in giving opportunity for comparison of a large variety of maps, text-books, etc.; it will be attractive to the intelligent public generally.

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OUR PRESENT KNOWLEDGE OF THE HIMALAYAS.[1]

THIS was the subject of an able paper read at Monday's meeting of the Royal Geographical Society, by Col. H. C. B. Tanner (Indian Staff Corps), who for many years has been one of the officers of the Indian Survey, most of his time having been spent in various parts of the Himalayas from north-west to south-east. The paper was illustrated by a large number of admirable drawings by the author, which afforded an excellent idea of the physical and picturesque aspects of this great mountain system.

With regard to avalanches, Col. Tanner stated that they play a great part in the conformation of the topography, — a greater part, indeed, than is generally supposed, — and this factor has not received the attention it deserves at the hands of geologists.

"I became acquainted," he said, "with four distinct kinds of avalanche, which, perhaps, are called by distinctive names by mountaineers, though I have been unable to ascertain them. The first, and the most common, is the precipitation of a mass of new snow from slopes which, from their steepness, are unable to retain more than a limited quantity of snow on them. They occur generally in winter and in early spring, and are the cause of the results just described. The second kind of avalanche is a descent of *old* snow, which is loosened by the heat of the sun. They may be heard throughout the summer and autumn, and are dangerous from the unexpected and irregular manner in which they slide off. The sportsman and traveller should guard against them by intelligently placing his camp in some sheltered spot out of their reach. This class is not usually of any great extent or weight, but such avalanches are of constant occurrence. The third kind can only be seen when the mountains are of peculiar formation or structure, and are really ice and not snow avalanches. They are of very constant occurrence in some localities, more particularly where small glaciers are situated high up on the crest of mountains, and are gradually pushed over the edge. In Lahaul, in the company of a friend, we watched the face of the well-known Gondla cliffs from the right bank of the Chandra River, and saw a number of these ice-falls, which came down every few minutes, filling the air with the noise of the loosened rocks and ice-blocks. The fourth kind of avalanche is one that I have only once seen, and have never known described. It is very curious, being the movements of billions of snowballs, which, in a stream a mile or half a mile long, I saw slowly wind down the upper part of an elevated valley in the Gilgit-Dareyl Mountains. I was after *Ibex* at the time of the occurrence, and was watching a herd of these animals, when I became aware of a low but distinct and unusual sound, produced by a great snake-like mass of snow winding down one of the valleys in my front. It occasionally stopped for a moment, and then proceeded again, and finally came to a rest below me. I found this curious movement of snow was produced by countless numbers of snowballs, about the size of one's head, rolling over and over each other. The torrent-bed was full of them, — an accumulation formed by numerous similar freaks of nature. I am quite unable to account for such an avalanche as the one now described. How does it originate, or by what process is the snow rolled up into these innumerable balls?"

[1] From Nature of April 30.

Col. Tanner made some interesting remarks on the subject of the line of perpetual snow. "Various authorities," he stated, "lay down such a line with great assurance; but for myself, I find that circumstances of position, of climate, and of latitude, play so great a part in the position of this line that I am unable to define it even approximately. No sooner in one locality, or during one particular season, have I settled, to my own satisfaction, the line of perpetual snow, than I presently have been obliged completely to modify my views on the subject. On p. 124 of the 'English Cyclopædia,' vol. v., I read that snow lies 4,000 feet higher on the northern than on the southern side of the Himalayas. On p. 281, vol. x., of the same work, it is stated that the snow-line on the northern slope is at 19,000 feet, which I should have been inclined to say is 1,500 or 2,000 feet too high. In Gilgit, during the end of summer, I found masses and fields of snow at 17,200 feet; and they extended down the northern slope certainly 2,000 feet, or even more, below that altitude. In Kulu, which has many degrees of latitude less than that of Gilgit, avalanche snow lies in valleys above 8,000 feet throughout the year after a good winter snowfall; but during the past spring, following a very mild winter, I found no snow at all at 8,000 feet. There had been no avalanches, and even in June, at 14,000 feet, snow lay only in patches. I think, that, in determining the snow-line with greater precision than has been done hitherto, scientific men should ascertain those altitudes on which perpetual snow lies on flat places in the position where it first falls, and should neglect the occurrence of a snow-field where it may have been protected from the sun's rays by its occurrence on the north face of a mountain. From memory I can state that there are a considerable number of typical localities which would help out such an inquiry. There is a peak (without a name) about thirty miles north of Gilgit, with rounded summit, which, though only 17,500 feet high, is covered with a cap of perpetual snow."

Speaking of the Himalayan glaciers, Col. Tanner stated that the most extensive and the most picturesque he has seen are in the Sat valley, which drains the southern face of Rakaposhi Mountain in Gilgit. Three great glaciers come down into this valley, and dispute with the hardy mountaineers for the possession of the scanty area of the soil. Here may be seen forests, fields, orchards, and inhabited houses all scattered about near the ice heaps. The only passable route to the upper villages in this valley crosses the nose of the greatest of the three glaciers, and threads its way over its frozen surface. This glacier is cut up into fantastic needles of pure green ice, some of which bear on their summits immense bowlders. About half a mile from its lower end or nose, Col. Tanner found an island bearing trees and bushes, and at one place above this a very considerable tarn of deep blue-green water. The glacier had two moraines parallel with each other, and both bearing pine trees; and, from the highest point Col. Tanner reached, he fancied he saw the ice emerging from the *névé* at its source, far away up the slopes of Rakaposhi. In this glacier the pinnacles, wedges, blocks, and needles of ice were of the most extraordinary appearance, and the whole formed a weird and impressive view which he can never forget. Though the largest glacier Col. Tanner has ever approached, it is very small indeed when compared with those described by Col. Godwin-Austen in a locality not very far from the Sat valley. Insignificant though it is, it was more than Col. Tanner could take in during his visit of two days' duration. It struck him at the time of his inspection that the peculiar stratified appearance of the ice needles, which in the case of the Sat glacier is very strongly marked, must have been caused by the different falls of avalanche snow on the bed of *névé* at the source of the glacier.

The lowest glacier Col. Tanner has seen in the Himalayas is one that reaches the foot of the range near Chaprot Fort in latitude 35½°, in Gilgit. It is formed of beautiful clear ice, and has no dirt. In Kulu and Lahaul (latitude 32°) glaciers do not come down below 12,000 or 13,000 feet, and all are very dirty; and in Sikkim (latitude 28° or 29°), without having visited the glacier region himself, Col. Tanner would say that the lowest limit reached by the Kinchinjanga group must be considerably higher, perhaps by 2,000 feet or even more. The smallest mountain he has ever met with, capable of giving rise to a glacier, is one on the Gilgit-Dareyl range, whose height is 17,000 feet; and in this case the mass of ice formed is of very inconsiderable size. Of the glaciers round Mount Everest and its great neighbors, we know next to nothing; and the little we have learned is derived from the itineraries of native explorers, who, of all classes of travellers, seem the least capable of furnishing trustworthy information regarding any subject lying at all outside their actual angular and distance measurements. But with his telescope, when employed on the survey of the Nipal boundary, Col. Tanner has gazed long and earnestly at the icy regions at the foot of Everest, and Peak No. XIII., where the glaciers extend over a very large area.

With regard to our actual knowledge of the Himalayas, Col. Tanner thinks that perhaps our botanical knowledge is far ahead of other branches of science. Many eminent botanists have been at work for a long time past, and of late Dr. Duthie has been allowed to travel on duty into tracts not before visited by any one possessing the requisite knowledge. It is likely that Dr. Duthie's museum at Saharunpur will, within a moderately short time, become an almost complete depository of the chief vegetable products of the Himalayas. The geologists, Messrs. Blandford, Edwin Austen, Richard Strachey, Stolitzka, and Lydekker, have been pretty well over those tracts open to Europeans, and are now well acquainted with all the leading features of their branch of science presented by the mountains of Kashmir, Kumaon, Kangra, and Sikkim. Ornithology has found many votaries, and the birds of these mountains are now probably all or nearly all known, though the late Capt. Harman, only a few years back, discovered a new and handsome pheasant in the extreme eastern end, either of Bhutan or Thibet. The mammals, Col. Tanner supposes, are all known, though one, at least, the Shao, or great stag of Thibet, has not even been seen by any European, and the famous *Ovis poli* has been shot by not more than two or three sportsmen.

With regard to the work of the survey, Col. Tanner stated that the maps of Kashmir and Gilgit, without being free from error, are of the greatest use to a large class of officials. Incomplete though they may be, they were not brought up to their present state without taxing to the utmost the endurance of a hardy set of men. Adjoining Kashmir to the eastward comes Kangra, with its subdivisions of Kulu, Lahaul, and Spiti. Kangra had once been roughly surveyed prior to the arrival there of Col. Tanner's party, who are now at work on a very elaborate contoured map, which will take a long time to complete, owing to the intricacy of the detail demanded. Between Kangra and Kumaon occur various native states whose territories are being surveyed on the scale of two inches to one mile, also contoured work, resulting in very elaborate and trustworthy, though somewhat expensive, maps. Eastward of Kumaon, Nipal stretches along our border for some five hundred miles till Sikkim is reached; and eastward again of Sikkim comes Bhutan, and various little-known and semi-independent states which lie on the right bank of the Sanpo River. Nipal marches with the Kumaon border for many miles, and advantage was taken of the existence of the trigonometrical stations on the Kumaon hills to extend our knowledge of the adjacent topography of Nipal, and this was done about four years ago with some little result. The more prominent peaks in Nipal within a distance of about one hundred and sixty miles were fixed trigonometrically, and some slight topographical sketching was done. From the trigonometrical stations near the foot of the lower hills, both in the North-West Provinces and in Bengal, trigonometrical points have lately been fixed, and some distant sketching done in Nipal, for five hundred miles between Kumaon on the western, and Sikkim on the eastern, extremity of this kingdom; and, again, from the trigonometrical hill stations along the western boundary of Sikkim more points and hazy topography of Nipal was secured. This very meagre topography, sketched from very great distances, comprises all the geography of Nipal other than the sparse work collected by Col. Montgomerie's explorers, or by explorers trained to his system who have worked since his death. All the existing data, whether trigonometrical, distant sketching, or native explorers' routes, are now being combined, as far as the often conflicting and contradictory materials admit. The resulting map of the country, though at most little better than none, is all we have to expect until some of the strictures on travelling in Nipal are lessened by the Nipal Government.

The whole of the Nipalese border, which marches with British territory for some eight hundred miles, is jealously guarded, and no European is allowed to cross it, except when the Resident of Kashmir, or his own personal friends, are permitted to proceed by a certain and particular route, between the military station of Segowli and Katmandu. Sikkim flanks the eastern boundary of Nipal, and the, until lately, indefinite western boundary of Shutan. British Sikkim is a small tract, which has twice been surveyed on suitably large scales. Independent Sikkim, which contains Kinchinjangee, one of the highest mountains, and some famous passes, — the Donkhya, visited by Sir Joseph Hooker and a few others; and the Jelap, where our forces, under Gen. Graham, have lately been employed, — was surveyed in reconnaisance style by Mr. Robert, an energetic and hardy assistant of the Survey of India Department. The sketch-map obtained by this gentleman is complete, and similar in character to that of Gilgit by Col. Tanner, and to that of Nari Khorsam and Hundes by Mr. Ryall. It does not pretend to any exhaustive detail.

Our knowledge of Bhutan, or, rather, our ignorance of it, is about on a par with that of Nipal; but in Bhutan we have the valuable information left by Capt. Pemberton, who forty-three years ago traversed the greater portion of the country from west to east. Besides Pemberton's work, Col. Godwin-Austen, while he accompanied Sir Ashley Eden's mission to the court of the Deb Raja in the year 1863, executed a route-survey in western Bhutan. The engineer officers who were attached to the military force at Pewangiri also did some little topographical sketching; and beyond this we have distant sketching and trigonometrical work, as in Nipal, which also has yet to be combined with the route-surveys of native explorers, some rather recent, and some of greater date. The difficulties which are presented to further researches in the direction of Bhutan geography seem unlikely to diminish. Our knowledge, then, of Bhutan is as unsatisfactory as that of Nipal. Eastward of Bhutan occur those numerous semi-independent hill-states which sometimes, when necessity presses, own allegiance to Thibet, and at others assert their complete freedom from control. Col. Tanner himself has sent in two maps of this region derived from native sources, and both upset maps previously accepted, and it is highly improbable that we have any but the most rudimentary and vague knowledge of the course of the Sanpo below Gyala Sindong, and not even that of the course or limits drained by the Dibong. Col. Tanner then referred in some detail to the great rivers that have their sources in the Himalayas, and concluded by giving some advice to tourists as to the best routes to take.

BANANA PRODUCTION.

THE banana industry, which, according to the "Handbook of the American Republics," was only commenced in 1883, is becoming more and more important every day. The bananas, which grow spontaneously in the tropical countries, have been from that date an article of commerce. Formerly they were planted in the coffee plantations to shade the young trees and shelter the grains from the wind that would sweep down the unmatured berry. The fruit of the banana was used to fatten pigs, or grew without any cultivation in the mountains and plains, thus going to absolute waste. Bananas principally come from the British West Indies, Cuba, Honduras, Costa Rica, Nicaragua, Guatemala, British Honduras, Colombia, Hawaiian Islands, and Salvador.

The lands chosen for the production of the bananas are those

that contain extensive alluvial deposits, composed chiefly of blue clay impregnated with marine salt, and rich in decomposed vegetable matter. On large plantations the trees are usually planted from twelve to fifteen feet apart, in the form of squares, and where irrigation is required, trenches are dug between them to admit the water passing through as often as it is necessary. In places where the rain is abundant, or where the soil is damp, the bananas grow best. It is generally at the end of nine months that the plants mature, and after that time the fruit can be gathered every week in the year, provided the plantation has been well kept, and has had a good start. At that time the trunk of the tree attains a height of eight or ten feet, and a girth of about thirty-six inches. From the trunk, which is porous and yields an excellent fibre, palm-like branches are thrown out to the number of six or seven. The bunch of fruit appears at the juncture of the trunk and branches, and consists of from four to twelve of what are termed "hands," each hand having eight to twelve bananas on it. A bunch of eight hands or clusters is counted as a full bunch; while those that have from five to seven are taken as a half bunch; bunches not less than five hands are styled third class, the others respectively first and second class. From the root of this tree several shoots or suckers sprout, each of which in turn becomes a tree, and bears a bunch of bananas, or they may be transplanted. After a bunch has been cut, the tree is usually felled; in fact, the tree is more frequently cut to gather the fruit. The manner in which the banana is cultivated is most easy, as very little skill or labor is demanded, nature doing almost all the work.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Origin of the Galapagos Rookeries.

IT is generally supposed that animals now living in latitudes bordering the polar circles are naturally confined to the cool regions of the earth, and such is usually the case; but there are some remarkable exceptions to this rule. Such, for instance, are the rookeries of albatross, fur seal, and penguin at the Galapagos Islands.

That this equatorial group of islands is inhabited by a fauna usually confined to the high latitudes has long been known to Pacific navigators, and also to such celebrated naturalists as Darwin and Agassiz, who visited them years ago. Still, there seems to be no satisfactory explanation offered to show why the fauna of the cold latitudes should now exist at the equator.

It may be that neither of the above naturalists, while having knowledge of the rookeries of hair seal, knew that a small rookery of fur seal made its home under the almost inaccessible cliffs of Abingdon, or that albatrosses had their hatching place on the shores of Hood's Island, or that a small species of penguin frequented the shores of Albemarle.

Under the present climatic conditions of our globe, it is not likely that the fauna of the cold regions would have selected breeding places under the equator, especially when such rookeries are so far removed from their normal home in the high latitudes. As their inhabitants are never seen far from the land of birth, I for many years after my first visit to these islands was unable to supply myself with a satisfactory solution of the problem. I at first thought that the albatrosses may have made the passage from their tropical rookery to the high latitudes through the upper atmosphere, which their great power of flight would enable them to accomplish. But I have since come to the conclusion that the Galapagos rookeries are the relics of a frigid period, and that their progenitors sought out these seemingly unnatural breeding places at a time when the climate of the Galapagos was much colder than now.

When we consider the low temperature which the eastern Pacific waters must have possessed during the ice-age, when the lands of southern Chili, and the shores of North America as far south as Oregon, were launching icebergs into the sea to be floated directly towards the Galapagos by the prevailing ocean currents, we can conceive how during such a frigid age the fauna of the high latitudes found a fitting home within this portion of the tropics. And it is owing to the ocean currents which still move from the high latitudes along the North and South American coasts, and cool the Galapagos seas, and also to the strong attachment of such species of life for their breeding places, that they have been able to continue, a feeble remnant, until the present century. Moreover, the isolated situation of the Galapagos may have aided, at the close of the ice period, to prevent the abandonment of the rookeries for a more congenial latitude. The nearest lands now suitable and occupied by such species of animals, as before stated, are situated in the high latitudes, thousands of miles distant from the Galapagos, while the wide intervening seas afford no signs of the albatross, seal, or penguin; and it is the opinion of seamen who are acquainted with the Galapagos rookeries that their occupants are confined to the seas of that region.

The rookeries of sea-lions found on these islands, and so well described by Mrs. Agassiz, are also far removed from the usual breeding places of such animals, the sea-lions of California being their nearest neighbors.

The large tortoises which inhabit the Galapagos, and from which the islands derive their name, probably emigrated at an early date from the American coast, which is some four hundred miles distant; for I have noticed that they appear quite at home in the water.

The progenitors of the terrestrial iguanas found on Albemarle, probably lived in the ocean in the remote past, according to Darwin's opinion, and are consequently related to the sea iguanas which abound in those waters. C. A. M. TABER.

Wakefield, Mass., May 16.

BOOK-REVIEWS.

A Journal of American Ethnology and Archæology. Edited by J. WALTER FEWKES. Vol. I. Boston and New York, Houghton, Mifflin, & Co., 1891.

Report of the Proceedings of the Numismatic and Antiquarian Society of Philadelphia for the Years 1887-1889. Philadelphia, printed for the society, 1891.

THE *Journal of American Ethnology* is scarcely such in the usual acceptance of the term. Its whole contents consist of three papers by the editor, all of them from his notes when connected with the Hemenway South-western Archæological Expedition. The first is entitled "A Few Summer Ceremonials at Zuñi Pueblo," principally descriptive of various dances. The second is on "Zuñi Melodies," the notes of which were obtained by Dr. Fewkes on phonographic cylinders exposed to the singing of various members of the Zuñi tribe, and subsequently taken down from the hearing with the aid of a harmonium. The instrumental study of the melodies is the work of Mr. Benjamin Ives Gilman, and is admirably presented. The third paper, accompanied with a map, describes a "Reconnoissance of Ruins in or Near the Zuñi Reservation." These ruins are those of the former residences of the Zuñi tribe, and are eighteen in number, though the reconnoissance is not asserted to embrace all that remain.

The *Journal* is admirably printed, well-illustrated, and full of excellent original material, although its title seems a misnomer.

The volume of proceedings of the Numismatic and Antiquarian Society of Philadelphia, edited by its efficient secretary, Mr. Stewart Culin, contains the usual lists, etc., and seven original papers, of all of which we can speak in terms of praise. One is by Mr. Culin himself, on a curious secret society among the Chinese in America, and two are by the Rev. Dr. W. M. Beauchamp, on the Onondagas and the early medals, crosses, rings, etc., found among them. Mr. B. S. Lyman, a high authority on all Japanese matters, describes an old Japanese standard foot measure; Mr. Frances Jordan, jun., speaks of aboriginal American wood-working; and the president of the society, Dr. Daniel G. Brinton, contributes a study of the character of American aboriginal poetry, and also an interpretation of a celebrated rock-inscription near Orizaba, Mexico, called "The Stone

of the Giants." Besides these, a number of abstracts of other papers are given. The volume is illustrated with numerous engravings, and is issued in creditable style. The society is to be congratulated on this evidence of its prosperity.

The Old Navy and the New. By REAR-ADMIRAL DANIEL AMMEN. Philadelphia, Lippincott. 8°. $3.

IN these days of the new navy we are apt to forget the old-timers, and all that they did to build up a solid foundation and educate the younger officers, so that the modern vessels can in their turn be models of efficiency as the wooden craft were. In this work the author tells a plain story of events, at home and abroad, just as he found them; and although he had no very startling adventures to punctuate his active career, there are many valuable lessons for officers about starting out for a naval life. The excellent habit of keeping a diary here bears good fruit, as the main dependence has quite evidently been placed upon notes taken at the time, with an occasional "freshening of the nip" by reference to official logs kept on board the vessels and afterward turned in to the navy department.

Among other points worthy of note are the meeting for the first time with men-of-war fitted with steam machinery, rifled guns, and other modern improvements of the day. The idea of the life-raft, or "balsa," which now forms an important feature in the outfit of vessels of war as well as passenger steamers, and for which thanks are largely due the author, seems to have struck him quite early in life. The efficiency of the ram as a fighting factor also impressed itself upon the admiral years ago, and the outcome is the modern ram that is now building for the navy.

The experience gained while on duty in the coast survey, and at the naval observatory, enabled the admiral, while chief of the Bureau of Navigation, to have carried on some very scientific work in relation to determining longitudes by telegraphy, and also surveys of the Isthmus, which latter are to-day resulting in the construction of the Nicaraguan Canal.

The former work by the same author, "The Atlantic Coast during the Civil War," so effectually covers the period of the Civil War that the present work unfortunately deals but slightly with the interesting events of that period. A very prominent feature of the book is the intimacy from boyhood that existed between the author and General Grant. The close of the volume contains some very interesting letters, which, among other things, show very plainly the very high regard and the warm friendship that the great hero of the war had for the admiral.

The book commends itself not only to professional men but to all who take a proper interest in the well-being of the navy.

AMONG THE PUBLISHERS.

AMONG the articles in *The Chautauquan* for June are, "The Intellectual Development of the English People," by Edward A. Freeman; "Hungary's Progress and Position," by Albert Shaw; "Studies in Astronomy, IX.," by Garrett P. Serviss; "The American Patent System," by Walter Hough; "Dr. Schliemann — The Excavator of Ancient Troy," by Thomas D. Seymour; "American Glass Workers," by F. M. Gessner; "Periodic Changes in Climate," by E. Richter; "The Latest Phases of Electricity," by Robert W. Prentiss; and "College Girls," by Kate Gannett Wells.

— "Philomythus, an Antidote against Credulity," Dr. Abbott's new book, is devoted to a discussion of Cardinal Newman's essay on ecclesiastical miracles. It will appear in a second edition, with a new preface, from the press of Macmillan & Co., New York.

— Mr. H. E. Haferkorn, Milwaukee, Wis., has published a translation, by Dr. Fr. Brendecke, of Koch's first communication to the *Deutsche Medicinische Wochenschrift* on the cure of tuberculosis. Explanatory notes have been inserted and the subject put into more popular shape by the editor, Dr. Max Birnbaum.

— D. C. Heath & Co., Boston, are just issuing "Comparative View of the Executive and Legislative Departments of the Governments of the United States, France, England, and Germany," by John Wenzel, assistant librarian of the College of Liberal Arts, Boston University. This consists of outlines of the four great constitutional governments, arranged in parallel columns in such a way that similar topics are grouped together. By this arrangement comparison can readily be made. Professor Woodrow Wilson of Princeton, the author of "The State," has examined the manuscript, and made suggestions and corrections.

— The seventh volume of the new edition of "Chambers's Encyclopædia," to be published in June by the J. B. Lippincott Company, will contain articles on "Mysteries," by Baring-Gould; "Cardinal Newman," by Hutton; and Mr. Blackmore discourses about orchards; Stanley Lane-Poole writes about "Mecca and Medina," Dr. Head on "Numismatics," Dr. John Murray on the "Pacific," and Canon Taylor on "Names." "Palestine" engages two contributors, Mr. Besant and Professor Hull.

— Certainly an entirely new departure in journalism is made in *The Engineering Magazine*, the first number of which appeared in April. This is not an addition to the numerous trade papers, but is intended to give each month, in untechnical language, articles by competent writers on engineering matters likely to interest the public. Such topics are: "Epidemics and Water Pollution," treated by George W. Rafter; "Danger Signals about the Boiler," by Robert Grimshaw; "The Rapid Transit Problem in New York," by T. Graham Gribble; "Building the Steamship in America," by Horace Lee; "The Tall Office-Buildings of New York," by John Beverley Robinson; "Our Old-Fogy Methods of reckoning Time," by Sandford Fleming; and "Splendid Record of the Electric Railway," by Frank J. Sprague. All these and more appear in the May number. The Engineering Magazine Company, World Building, New York City, are the publishers.

— The North Carolina Experiment Station has just issued a twenty-page bulletin (No. 76) on plant-diseases, by Gerald McCarthy, the station botanist, illustrated by eleven engravings showing the appearance of diseased plants and the best forms of spraying-apparatus. This bulletin contains a brief and pointed chapter on vineyard and orchard hygiene, and treats in full of the following diseases: rot, mildew, and anthracnose of the grape; peach-rot; black-knot of plum and cherry; apple, pear, and quince scab; leaf-blight of pear; fire-blight of pear; peach-yellows; potato-blight; rust of cereals; bunt of wheat; smut of oats; smut of corn; ergot of rye. This bulletin will be sent free to all names on the regular mailing list of the station, and to others within the State who apply for it. Only a limited number of copies will be available for distribution outside the State. These will be sent, so long as the supply lasts, to applicants who inclose six cents. Address North Carolina Experiment Station, Raleigh, N.C.

— Messrs. Fords, Howard, & Hulbert have published a small book by Amos K. Fiske entitled "Beyond the Bourn." It purports to give the experience of a man during a visit to the spirit-world, whither he was transported while he lay unconscious from a railroad accident. He meets his old friends in the spirit-world, who instruct him in the mysteries and the enjoyments of the life they lead. A considerable portion of the book, however, is occupied with the account of a visit which he and his spirit friends made to a planet far distant from the earth, but peopled by a race of beings similar to men, only in a more advanced stage of development. They are represented as living in a veritable Utopia, surpassing even Mr. Bellamy's; yet they have reached it by voluntary action and co-operation without any help from the State. The book is fantastic throughout, and for the most part shallow, and it sheds no light on the great subjects with which it deals.

— Some photographs of luminous objects (taken by their own light) will be reproduced in the June *Scribner* by mechanical processes, directly from the original negatives. All amateurs will be interested in the pictures, which show fireworks, interiors by lamplight, rolling-mills, electric discharges, sun-dogs, and other curious subjects. William H. Rideing (who has all his life been familiar with steamship affairs) contributes to the same number the third of the Ocean Steamship series, on "Safety on the Atlantic." He gives an account of the precautions and devices which have made ocean travel one of the safest methods of locomotion. He prints the following remarkable record for 1890: "Nearly two thousand trips were made from New York alone to

various European ports; about two hundred thousand cabin passengers were carried to and fro, in addition to nearly three hundred and seventy-two thousand immigrants who were landed at Castle Garden. This enormous traffic was conducted without accident, and no more comforting assurance can be given than this of safety on the Atlantic."

— In "The Compounding of English Words," a neat little volume, of which F. Horace Teall is author and John Ireland publisher, a praiseworthy attempt is made to show when and why the joining or the separation of certain words is preferable. Concise rules are given in relation to the use of the hyphen and the "solidifying" of separate words into one without the hyphen; also lists of words showing the author's preferences in these matters. "Preferences" they must necessarily be called, for, notwithstanding the many excellent reasons given for some forms of words, and other reasons not so good for other forms, the thousands of writers, printers, teachers, proof-readers, and others, to whom the book is dedicated, and to whose interests it appeals, will still continue to use their individual preferences, — and they mould that department of language, or rather, defy all attempts to have it moulded into any semblance of uniformity. While the author claims this to be the "first systematic attempt to disentangle the perplexities of English compounding," he gives due credit to Fowler, Wilson, and others, who have made some slight efforts in the same direction. The book will be of value to all whose work lies in its direction, whether they accept its conclusions or not; for it gives, in little space and convenient form, all, or nearly all, the words about which there are differences of opinion, with the reasons for the author's preferences of particular forms clearly stated.

— We have received from Ginn & Co. "A Higher Algebra," by G. A. Wentworth, professor of mathematics in Phillips Exeter Academy. The work gives in one volume a preparatory course for colleges and scientific schools, besides providing a sufficiently full treatment of the subjects usually read by students in such institutions.

— The fifth paper in the *Popular Science Monthly's* illustrated series on the development of American industries since Columbus will describe "The Manufacture of Wool." It will appear in the June number, and the writer is S. N. Dexter North, secretary of the National Association of Wool Manufacturers, and special agent of the Eleventh Census. In the same number appears the concluding part of Dr. Andrew D. White's paper on "Miracles and Medicine," and "Our Grandfathers died too Young," under which odd title Mrs. H. M. Plunkett describes the progress in sanitation which has doubled the average length of life in civilized countries within a few hundred years. Lieutenant-Colonel A. B. Ellis contributes an essay on "Survivals from Marriage by Capture." "The Pearl of Practice" is the title of a book of medical prescriptions, printed in London over two hundred years ago, some

Publications received at Editor's Office, May 11–19.

GETTING Married and Keeping Married. (Human-Nature Library.) New York, Fowler & Wells. 22 p. 12°. 10 cents.

GRAHAM, DOUGLAS. A Treatise on Marriage, Theoretical and Practical. New York, Vail (2d ed). 342 p. 8°.

LETOURNEAU, C. The Evolution of Marriage and of the Family. New York, Scribner. 378 p. 8°. $1.25.

MICHIGAN, Seventeenth Annual Report of the Secretary of the State Board of Health of the State of, for the Fiscal Year Ending June 30, 1889. Lansing, Thorp pr. 324 p. 8°.

POSTAL Savings Banks. An Argument in their Favor by the Postmaster-General. Washington, Government. 72 p. 8°.

THORNTON, W. Origin, Purpose, and Destiny of Man; or, Philosophy of the Three Ethers. Boston, The Author. 100 p. 12°.

WENTWORTH, G. A. A Higher Algebra. Boston, Ginn. 521 p. 12°. $1.55.

extracts from which are embodied in an article by Miss Elizabeth Robinson to appear in the same issue. After reading the list of ingredients in some of these unsavory messes no one need wonder about the origin of the saying, "The remedy is worse than the disease."

— Arrangements for instruction in botany at the Marine Biological Laboratory have now been completed, and Mr. Setchell of Harvard University will again take charge of the work in this department. Applications for places in either department should be addressed to Miss A. D. Phillips, secretary, 23 Marlborough Street, Boston.

— Among the fifteen candidates recently selected by the council of the Royal Society (London) to be recommended for election into that Society is George Mercer Dawson, D.Sc., F.G.S., A.R.S.M., F.R.S.C., Assistant Director of the Geological Survey of Canada. His qualifications for membership, as summarized in *Nature* of May 7, are as follows: Much important and valuable work, more especially in geology and ethnology, as in the following summary statement. During his thirteen years of service on the Geological Survey (Canada) has been chiefly engaged in working out the geology of the North-West Territory and British Columbia; placed in charge of the Yukon Expedition, 1887; author of numerous papers, chiefly geological, but including geographical, ethnological, and other observations, published in the *Quarterly Journal of the Geological Society*, "Transactions Royal Society, Canada," *Canadian Naturalist*, etc. These deal more especially with the superficial geology of the regions explored, but some describe *Foraminifera* and other microscopic organisms. Author of fifteen reports published by the Geological Survey of Canada, and joint author (with Dr. Selwyn) of a "Descriptive Sketch of the Physical Geography and Geology of Canada," and (with Dr. W. F. Tolmie) of "Comparative Vocabularies of the Indian Tribes of British Columbia."

SCIEN[redacted]

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NINTH YEAR.
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NEW YORK, MAY 29, 1891.

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CALENDAR OF SOCIETIES.

Anthropological Society, Washington.

May 19.—Robert Fletcher, Hoopa White-Deer Dance; Stuart Culin, Social Organization of the Chinese in America; W. W. Newell, The American Folk-Lore Society.

Philosophical Society, Washington.

May 28.—Robert T. Hill, Some Recent Geographical and Geological Explorations in the South-west; F. H. Newell, Stream Measurements in the Western United States; D. E. Salmon, On the Objects and Methods of the System of National Cattle and Meat Inspection.

Natural Science Association of Staten Island.

May 9.—Arthur Hollick, Fungi Collected at Tottenville; L. P. Gratacap, The Lymnia palustris; W. T. Davis, Botanical Notes.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, ***if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.***

A CHEMIST, who has taken a thorough course in chemistry in one of our best institutions, would like a position as assistant in an iron firm or in any industrial establishment. Correspondence solicited. JOHN N. BARBER, Box 743, Amherst, Mass.

AN experienced tutor, Latin, English, German, Science, wishes an engagement in High School or Academy for September commencing. H. L. M., 243 West 45th Street, New York City.

A GRADUATE of Yale College, now a medical student, who has made a specialty of the sciences, wishes employment during the summer vacation, from June 15th, to Oct. 1st, GEO. N. LAWSON, 22 College St., New Haven, Conn.

WANTED.—A permanent position that will pay $15 per week with prospect of advancement, by a young man (23) and college graduate of one year's experience. Address J. S. M., care of SCIENCE, 47 Lafayette Place, New York City.

WANTED.—Vols. I and II. of Allen's "Commercial Organic Analysis." SCIENCE BOOK AGENCY, 47 Lafayette Place, New York.

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WANTED—A position in some College, Normal School or Academy to teach Biology, Physiology, Comparative Anatomy, Histology, Embryology or Botany. A graduate of the University of Wisconsin. Have had four years' experience as a teacher. Address "BIOLOGIST," care SCIENCE.

WANTED.—All of Vol. I. of *Journal of Analytical Chemistry*, published at Easton, Penn. State price and condition. SCIENCE BOOK AGENCY, 47 Lafayette Place, New York.

WANTED—A position in a Summer School of Gymnastics to teach any one or more of the following named physical exercises, viz.: Fencing (to ladies especially), Sparring, Club Swinging, Wands, Chest Weights and Free Movements. Am prepared to offer very favorable terms to any school desiring such work. WILLIAM FINDLAY, Proprietor of Phila. Inst. of Phys. Cult., 1009 Arch Street, Philadelphia, Pa.

Exchanges.

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For sale, or exchange for geological works, the following works in anatomy, all latest editions: Allan, Tusin, Gray, Leidy, Massey, and Rollestin's Forms of Animal Life. S. W. Williston, Lawrence, Kan.

Will exchange a new Thomson reflecting astatic galvanometer, about 6,000 ohms, made by Clark, Muirhead & Co., London, and costing £30, with 1-9, 1-99, 1-999, shunts, lampand scale, for a Weston voltmeter and ammeter, or arge Wheatstone bridge, dial pattern, or a portable testing outfit. Address G. A., *Science* Office, 47 Lafayette Place, New York.

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorlemmer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

SCIENCE

NEW YORK, MAY 29, 1891.

PRESIDENTIAL ADDRESS OF SIR FREDERICK ABEL OF THE IRON AND STEEL INSTITUTE.

THE address of Sir Frederick Abel, the new president of the Iron and Steel Institute, London, at its annual meeting in the early part of this month, as reported in *Engineering*, is full of interest. Sir Frederick went back to the date of his first labors in connection with the iron and steel industry, when, as he said, those in England who could appraise at their proper value the services which the analytical and scientific chemist could render to the ironmaster and manufacturer of steel could be counted upon one's fingers. Shortly before the outbreak of the Russian war, Sir Frederick succeeded the illustrious Faraday in the professorship of chemistry at the Royal Military Academy. The metallurgical operations in the arsenal were then limited to the production of small castings of brass for the fittings of gun carriages, and to the casting of bronze ordnance for field service, which had been carried on at a foundery in Moorfields until 1716, when the services of an experienced Dutch founder, Andreas Schalch, were secured by the government, and a foundery for brass ordnance was established in the Warren at Woolwich, afterwards named the Royal Arsenal. The supplies of cast-iron ordnance for siege and naval use were drawn from a very few of the most renowned iron works, such as Carron, Low Moor, and Gospel Oak, and shot and shell were exclusively supplied from private works. The president next went on to draw a comparison between the old cast-iron smooth-bore ordnance of those days and the elaborate steel breech-loading weapons of the present time.

During the Crimean War more than one disastrous experience with some armaments, supplied by contract during great pressure, led to the adoption of the proposal to establish government founderies and factories in the arsenal for the production of guns and projectiles, and it was with the view of selecting suitable varieties of cast-iron for the production of ordnance and projectiles that a very extensive analytical examination of ores, fuel, and fluxes, and of samples of iron produced from these at various works in the United Kingdom, was carried out under Sir Frederick's direction in 1856–58, together with a series of mechanical experiments with the metal cast under conditions practically identical, and cooled in various ways.

The president next referred to the confusion arising from the different methods of analysis pursued in the determinations of the proportions of alloys in a sample of iron, and gave some particulars of what had been done to bring uniformity in this respect between the chemists of various countries. The consideration of this subject was first prominently brought forward at the Bath meeting of the British Association in 1888 at the instigation of Professor J. W. Langley of Michigan University, who reported that he had, in conjunction with Professor Herman Wedding and Professor Akerman, considered a general plan of operations having for its object the promotion of greater uniformity in analysis in the countries which are the principal producers and users of iron and steel; the proposal being to prepare a series of absolutely identical samples, to distribute these for analysis among highly qualified operators selected in different countries, the results being afterwards compared, and to deposit portions of the samples in those countries as international standards, which might be utilized at any time for testing or controlling the accuracy of individual work, in cases of importance, or for testing the value of new analytical processes. It was decided by the association to appoint a committee of English experts to co-operate with Professor Langley and his associates in other countries, and this committee prepared a number of suggestions with reference to the preparation of a series of five samples of steel, containing, as nearly as possible, specified total proportions of carbon ranging from 1.3 to 0.07 per cent; the samples to be sufficiently large, after providing material for the required analyses by the selected referees, to allow of the disposition of about ten pounds of each standard in each of the different countries interested; the samples to be subdivided into series of small specimens, hermetically sealed in glass tubes, so that portions should be available for supply to applicants without detriment to the remainder of the samples. These suggestions were approved, and have been acted upon as closely as possible, the material for the standards and the mechanical work having been supplied gratuitously by the Crescent Steel Works of Pittsburgh. The samples were despatched to their several destinations in the summer of 1889, and the experts selected for the conduct of their analysis in England have almost completed the work assigned to them.

The address next referred to the method of examination of iron and steel introduced by Dr. Sorby, consisting of microscopic inspection of prepared sections of metal after treatment with weak acid. Faraday and Stodart had formerly proceeded upon somewhat similar lines. Dr. Wedding states that Sorby's system is continually extending at the German works, and that many series of experiments have demonstrated that by this system of examinations characteristic features of grades of iron may be discovered, physical differences co-existing with identity of chemical composition explained, and evidences of the true grounds of disasters obtained. The president also referred to his own labors in a similar direction, in connection with his inquiry into the erosive action of the powder gases, when he showed, in a paper read before the institute, that the development of structure of smooth surfaces of slices of the metal composing the barrels with which experiments were carried out by the very slow solvent action which a chromic acid solution exercises, afforded valuable evidence, attainable by simple inspection, of the comparative amount of work or mechanical treatment to which the different steel forgings had been subjected, and which was demonstrated to affect very importantly the amount of resistance opposed by the surface of the gun's bore to the erosive effects of powder gases. This method of examination, and the production of photographic records of the results, had, however, already been made use of by Sir Frederick twenty-six years ago, at the time when the government first entered upon experiments with projectiles of wrought iron and of steel, for use against armor-plates; and he exhibited some photographs of small plates of metal, exhibiting the effect of the chromic solution referred to, which were attached to a report made by him to the Ordnance Committee in 1865.

Sir Frederick Abel also referred to the microscopic method pursued by M. Osmond in connection with the Le Chatelier pyrometer.

The development of cracks in stored steel projectiles next occupied the president's attention. Previously to 1865 this then new phenomenon had been the subject of an official report he had made. Up to the present day this difficulty has not been altogether overcome, and in the case of built-up steel guns the troubles arising through internal strains due to hardening or tempering have taxed the powers of some of our most eminent scientific and practical authorities. The difficulties which had to be encountered by manufacturers in the production of solid projectiles on the molecular stability of which reliance could be placed, was illustrated by a statement made by an eminent firm, then already possessed of considerable experience in this special manufacture, to the effect that although they were then successful in tempering steel shot without difficulty — by cooling them uniformly both externally and internally — this result had been preceded by many failures. The successful manufacture, within the last five or six

years, by Holtzer, the St. Chamond and Firminy Companies, and other French makers, of the hardened chrome-steel armor-piercing projectiles having only small cavities (without which their production would probably be practically impossible), is a remarkable illustration of the control which has been acquired over the treatment of steel, and especially of varieties, such as this chrome-steel, to which a very exceptional degree of hardness may be imparted without detriment to tenacity, by carefully elaborated processes of hardening and tempering. Experience in the application of these appears to have conquered, at any rate, in very great measure, the originally considerable tendency to the retention of a state of unequal tension by the finished material for long periods, and the frequent yielding of the mass to the disruptive force thereby exerted.

In visiting, in 1886, the several works at and near St. Etienne, where the chrome-steel projectiles were being produced (their successful manufacture being then of comparatively recent date) Sir Frederick saw, at more than one establishment, a large number of projectiles which had sustained spontaneous fracture. In one store where the finished shot were stacked, after the lapse of the period during which the tendency to the development of cracks or to rupture was stated to diminish gradually, he saw the head of one out of a pile of projectiles which had quite recently been projected to a distance of many feet by the violent spontaneous rupture of the metal. Instances of the development of flaws in these projectiles are now, so far as experience at Woolwich goes, exceedingly rare.

The address next proceeded to point out the importance of rest in bringing about a diminution, if not an entire disappearance, of internal strains; and he referred to the analogous case of steel dies for coining. Sir Thomas Graham had written the president a letter in 1865, in which he stated that, if kept in store a year or two, these dies became less apt to crack when in use, and coined more pieces than dies newly tempered. The more important question of internal strains in masses of steel composing the tubes or barrels of guns next received attention in the address. The condition in which the steel might have been, in such instances, when subjected to the action of the exploding powder charge, may be illustrated by reference to the behavior some years ago of the tube of a large gun, in which, after the third proof-round was fired, a circumferential crack was found to have become developed in the front threads of the breech screw. Upon removing the jacket from the tube, the crack extended forward along the chamber and into the rifling, and when the tube was placed in the lathe with a view of cutting off the injured portion, the crack suddenly developed itself with a loud report, and ran along to within eight feet of the muzzle; a spiral crack at the same time ran completely round the tube, which fell in two upon removal from the lathe.

The tempering with oil hardening of steel guns has been demonstrated to result in the development of more or less severe internal stresses in the mass, which can only be removed by subsequent careful annealing; and until this latter practice was largely adopted, instances occurred from time to time at Woolwich, and at other gunmaking establishments, of the fracture of tubes and hoops of guns, either during their treatment in the workshop, or when at rest, or when, in the built-up condition, they have been for the first time exposed to the shock produced by the firing of the gun. One effect which the oil-hardening treatment has occasionally exercised in the case of particular qualities of steel is that of developing minute fissures or cracks in the metal, either superficially or in the interior of the mass. This could not be rectified by any annealing process, and it is still a question, to be determined by the teachings of experience and the results of investigations, whether any definite or reliable modifications in the composition of steel used for guns, tending to secure the desired combination of hardness and tenacity, may not be introduced, with the result that a method of treatment of the metal may be discarded, which — however carefully applied, and however efficient the means adopted for reducing or neutralizing any possible prejudicial influence upon the physical stability of the parts of which a gun is built up — carries with it inherent elements of uncertainty and possible danger.

Turning to another branch of this subject, the president next dwelt upon the investigations of Mr. Thomas Turner and Mr. Keep upon the influence of silicon and other impurities in cast-iron, a question which Sir Frederick had taken up in 1855. The work of Gautier, Ledebur, and others, based upon Turner's information, and the investigations of German experimentalists, have combined to establish on a sound footing the value of ferro-silicon in connection with the treatment of cast-iron. Jüngst's experiments seem to indicate clearly the conditions under which silicon will contribute to the production of dense and homogeneous castings.

Sir Frederick then made some observations on the development of the basic process, and also the effect of aluminum and of manganese as alloys of iron. The question of nickel-steel also occupied a good deal of the address, Sir Frederick giving an excellent *résumé* of what has already been done in this direction chiefly in connection with armor-plate construction.

EPIDEMICS OF CHOLERA FROM 1830 TO 1890.

DR. WILLOUGHBY, in a paper before the Epidemiological Society of London, condensed in a recent number of the *Lancet*, after alluding to the doctrine of epidemic influences, telluric and atmospheric conditions, and other unknown agencies, as at once baseless and needless, and to the opposite delusion, prevalent in the south of Europe, of its being infectious in the same sense as small-pox, asserted that all the independent and scientific students of the subject in Europe and America were now agreed that the vehicle of contagion was contained in the evacuations, that it was thus carried by fomites as soiled clothing, etc., while persons suffering from the disease, even in unrecognized and mild forms, infected the soil and water of places through which they passed. Insanitary conditions favored its development, but the most insanitary towns — as Rome, Seville, and others — had escaped, since they had been provided with pure water supplies.

The incubation period he believed to be, as a rule, from one to two days, four being an ample limit for quarantine purposes. Its transportability and conveyance wholly and solely by human intercourse was proved not only by the progress of every epidemic having followed the great routes of trade and pilgrimages, but by the rapidity of this progress having corresponded to the facilities for travel, whether by caravans, river boats, railways, or ocean steamers, quoting in this connection Dr. de Renzy and others as to the altered circumstances of travel in northern India; and he thus explained the immunity of Australia and Chili, virtually the most isolated communities in the civilized world.

It was, he said, in 1821 that cholera, so far as was known, first advanced from India westward, reaching Astrakhan in 1823, but subsiding until 1827, when a fresh wave swept over Persia, entering Russia in 1829. In 1830–31 it was fomented by the war in Poland; in 1831–32 it spread over the whole of Europe, and in 1832–33, over North America, lingering in each continent for about two years longer. It was remarkable, and totally inconsistent with the theory of conveyance by winds, that, though some cases had occurred on board ships in the Medway as early as July, 1831, it did not reach London till February, 1832, having effected a landing at Sunderland and travelled via Newcastle, Edinburgh, Glasgow, Belfast, Dublin, and Cork, whence it was at length brought to London.

A wave rolled over Persia, Arabia, and Syria between 1836 and 1839, but retired again. In 1840 it entered China, then passed westward through Central Asia, re-entering India from Afghanistan and through northern Persia, reaching the Caspian and Black Seas in the summer of 1847. Following the military road then in course of construction from the Caucasus to Moscow, and the river highway of the Volga, it was intensified and spread by the fair at Nijni Novgorod and the massing of the Russian, Austrian, and insurgent Hungarian armies on the Danube, and in the course of 1848–49 had attacked every country in Europe except Denmark and Greece, which were saved by stringent quarantine. It extended to America in 1849, but died out in the course of the following year.

The epidemic of 1854 was not strictly a separate invasion, but rather a resuscitation of the last, which had lingered in the south and east of Europe and the west of Asia until called into fresh activity by the Crimean war. Every country in Europe and America was again invaded. The incidents of the outbreaks in America threw great light on the conveyance of the disease by fomites. The epidemic of 1865–66, which was the first to come wholly by the Red Sea, spread rapidly over Europe and America; but had scarcely subsided when a fresh explosion occurred at the Hurdwar fair in India in 1867, whence it was carried to Persia and Russia, being re-intensified *en route* by the pilgrimage at Great Meseched in 1868, and the fairs at Nijni Novgorod in 1869 and 1870.

At the close of the Franco-German war every country in Europe was attacked except Great Britain, and America succeeded in averting its importation until 1873. By 1874 it had, however, disappeared everywhere on this side of India. In 1881–83 it prevailed in Arabia and Egypt; in 1884 it made its appearance in France, and soon raged throughout Italy and Spain. The influence of pure water supplies was brought into special prominence, not only in the case of single towns in Italy and Spain, but in the almost complete immunity enjoyed by Germany, which had previously suffered heavily in every epidemic.

Cholera lingered in the south until the end of 1885, since which date it had been absent from the continent of Europe until the isolated outbreak in Spain in 1890. This, Dr. Willoughby was convinced, was not imported from the East, but was a recrudescence of the epidemic of 1884–85, brought about by excavations in infected ground. Still cholera had, since 1888, been slowly but steadily advancing by the Persian Gulf and the extensions of that route. It had last year reached the shores of the Caspian and Black Seas, and had raged at Mecca, though Egypt had almost miraculously escaped, and it had persisted at Aleppo and the Syrian ports certainly as late as January of the present year. He had little doubt, that, as its march had closely corresponded with that in 1845–47, we might expect history to repeat itself in an invasion of southern and eastern Europe during the coming summer, unless, as in 1828 and 1839, it should retire, after having thus approached the confines of Europe. If, however, it had not already really died out, the vast increase of communication between the two continents rendered such recession less probable than it was fifty years ago. The paper was illustrated by a number of maps showing the great routes and the course of each epidemic in Asia, Europe, and America.

NOTES AND NEWS.

DURING the early part of May, according to the Cairo correspondent of the London *Times*, there have been in Upper and Lower Egypt large swarms of locusts, which have caused much alarm, as it is believed that they originate from eggs laid last year. The damage done to the young maize, sugar, and cotton is as yet insignificant, though some individual growers have had to re-sow cotton patches which had been devastated. The provincial mudirs have received orders to do everything in their power to secure the extermination of the locusts. The correspondent says that this is the most serious reappearance of an old Egyptian plague that has been recorded for about forty years.

— The National Geographic Society was organized in January, 1888, "to increase and diffuse geographic knowledge." It is incorporated under the laws of the District of Columbia, and has at present an active membership of about four hundred. The publication of a magazine was early determined upon as one of the means of increasing and diffusing geographic knowledge, and two volumes of the *National Geographic Magazine* have been published in the form of a quarterly journal. During the past two years it has been found that the form of publication adopted at the outset meets but imperfectly the needs of the society. In the first place, since the season of active work in the society includes the winter months only, there was an excess of material for the two earlier numbers and a dearth of material for the two later numbers of the volume; and in the second place, the necessity for holding articles until sufficient material for a number was received sometimes led to delay in publishing interesting and important matter. Accordingly it has been decided to discontinue the quarterly form and to publish the magazine in the form of a series of brochures, each issued as promptly as possible after reception of the material. While the *National Geographic Magazine* is edited by and constitutes the organ of the National Geographic Society, it is not limited to this function; and, as was announced in the first number of the journal, "its pages will be open to all persons interested in geography, in the hope that it may become a channel of intercommunication, stimulate geographic investigation, and prove an acceptable medium for the publication of results." The aim of the founders has been to form a continental rather than a local society. That this aim has measurably succeeded is indicated by the fact that although the National Geographic Society is only three years old there are fifty-seven non-resident members, distributed over twenty-seven states and territories. One of the means adopted by the National Geographic Society for increasing geographic knowledge has been, as is well known, that of exploration.

— The annual report of Daniel Draper, Ph.D., director of the New York Meteorological Observatory for the year 1890, shows that during the past year the daily work of the observatory has been uninterruptedly kept up, and complete registers have been obtained of the temperature and pressure of the air; of the direction, force, and velocity of the wind; of the total amount of every rain, the temporary variation of every shower, and the depth of every snow. Not a day, even including Sundays and holidays, has been lost. The registers containing all this large amount of information have been properly arranged and filed away in suitable books. Readings are taken at Smithsonian hours, and also hourly readings from self-recording instruments. Eye observations of clouds are recorded, and the daily and monthly means, etc., are calculated from the instrumental records.

— Bulletin No. 49 of the Ohio Agricultural Experiment Station contains a communication from Mr. G. B. Strong of Cuyahoga County, Ohio, giving an account of his experience in spraying plum-trees the past season. He sprayed forty trees with London purple, at the rate of one pound to 150 gallons of water. Three applications were made, the first one being applied when the fruit was about the size of a small pea. The spray was put on until the leaves began to drip. Twenty-five bushels of plums were gathered from the forty trees, and not one per cent of the crop was stung. Two trees in the vicinity that were not sprayed had all their fruit stung. The foliage was injured somewhat, so Mr. Strong says that the solution was too strong, and that hereafter he will use one pound of London purple to 200 gallons of water, spraying more lightly, and applying only twice unless a third application becomes necessary. It is probable that Paris green would be better for spraying plum-trees than London purple, as it usually contains less soluble arsenic, and consequently is less liable to injure delicate foliage. It may be used at the rate of three ounces to fifty gallons of water. Some spraying experiments were also made by Mr. William Miller, a leading fruit grower of Ottawa County, Ohio. Having two pear orchards several rods apart, the fruit of which had for some years been greatly injured by the plum curculio, he determined to spray one of them. The larger orchard, containing several hundred trees, was accordingly sprayed twice with London purple — four ounces to fifty gallons of water. The fruit in this orchard was very much less injured by the curculio and other insects than that in the other orchard, which had not been sprayed. Mr. Miller also found the spraying machine a decided help in fighting the curculio in his plum orchard, although he did not rely upon it altogether, but used the jarring method part of the time. In 1888 the station sprayed a number of pear trees with London purple in the proportion of eight ounces to fifty gallons of water. At the same time other trees were sprayed with the same mixture, except that half a peck of fresh slaked lime was added. It was then found that while the trees sprayed with London purple alone had their foliage decidedly injured by the application, those sprayed with the lime and Lon-

don purple were not affected. In 1890 these experiments were repeated in such manner as not only to show the effect of adding lime, but also to determine whether Paris green or London purple is the more liable to cause injury to the foliage. The results of these experiments fully confirm those of 1888 and 1889 in showing the advantage of adding lime, and they further show that Paris green is much less liable to injure foliage than London purple.

— The Massachusetts Board of Health, who for some years past have been experimenting on the treatment of sewage by land filtration, have recently issued a report on the subject, in which they remark that sewage can be more efficiently filtered through open sand than through sand covered with soil. Very fine material like dust in the upper layers of a filter prevents access of air, and when wet, may do this so thoroughly that purification of the sewage is entirely prevented. By allowing periods of intermission, however, so as to allow the upper layers of the filter to dry, a high degree of purification may be attained. The quantity which can be dealt with is, however, then much below that which can be purified when the upper layers are composed of open sand, through which the sewage will rapidly disappear, leaving room for air to enter and come in contact with the thin layers of liquid covering the particles of sand. Filtering areas of sand covered with soil are much increased in efficiency by digging trenches in the direction of a slight incline, about two feet deep and six feet apart, and filling them with coarse sand, the upper layers of which should be removed about once a month and replaced by clean sand. From bacteriological experiments it was found that when the filters were in proper working order the number of organisms in the effluent from the filters were never more than two per cent of those in the raw sewage, and the board think this result may be much improved. Fine sand was found to make a very good filter, being capable of purifying sewage at the rate of 9,600 gallons per acre per day, the number of bacteria in a cubic centimetre of the sewage being reduced from 591,000 to 2,000, and the ammonias to a quarter of one per cent of those in the unfiltered fluid. Garden soil made a very poor filter, but a mixture of fine sand and gravel gave extremely good results, as 25,000 gallons would be purified by it per acre per diem in winter, and 42,000 gallons in summer; the bacteria being reduced from 350,000 per cubic centimetre in the sewage to 14,000 per cubic centimetre in the effluent. Peat was totally inefficient. A filter of sand and loam gave good results as far as purity was concerned, but the rate of filtration was only one-third as great as that of the sand-and-gravel filter.

— At a meeting of the Paris Geographical Society in December last, a letter was read from M. Paul Crampel, the substance of which is given in a recent number of the *Scottish Geographical Magazine*. In his letter M. Crampel describes a dwarf race inhabiting the forests to the north of the Ogowé. M. Crampel found several families of this people at about 13° 20′ east longitude, and 2° north latitude, living among the Fans in a state of vassalage. When a Fan chief becomes sufficiently powerful, he takes under his protection a group of these dwarfs, and establishes them in the bush near his village. They then become his hunters, and, in exchange for the ivory and meat they procure, receive old rags, broken guns, manioc, etc. The Bayaga, on their side, enter this state of servitude voluntarily, for, having no plantations, they cannot otherwise procure vegetable food; but when their feudal lord is too exacting, they leave the neighborhood. Their average height is four feet seven inches. They are squarely built, well proportioned, and muscular. The color of the skin is a yellowish-brown, and hair grows all over their bodies. At first sight one is struck by the prominence of their bushy eyebrows and their high cheek bones. They have short necks, high shoulders, broad and rounded chests, strong arms, and thick wrists. When at rest, their feet are generally turned inwards, and their knees, calves, and feet seem as though they were all in one piece. Their general expression is one of fear, and when any one looks at them they hang their heads and appear to tremble. Each head of a family lives with his children and grandchildren, and into this little community no stranger blood is admitted. When a young Bayaga wishes to marry, he is provisionally adopted into the family of his intended bride, and, after a long period of service in hunting and collecting honey for the community, is allowed to marry; but he must still remain in the family of his wife until he has a son, and this son has killed an elephant. He may then depart with his wife, leaving the son in her stead. Polygamy is permitted, but the scarcity of women and the family organization place great obstacles in the way of its practice.

— For the preservation of hydrogen peroxide Kingzett recommends the addition of a small amount of ether. Experiments conducted by the author show, according to the *Medical Record*, that pure hydrogen peroxide lost, in twenty-eight days, 10 per cent; in ninety-eight days, 27.4 per cent; in two hundred days, 39 per cent; and in four hundred and ninety days, 89.2 per cent. The addition of sulphuric acid reduced these figures to 9, 23, 27½, and 68.3, respectively. Alcohol reduced them to 1.7, 4, 7.4, and 52.8, respectively, while ether still further reduced them, showing a loss of the peroxide in the times mentioned of 0, 1.3, 2.4, and 15.9, respectively.

— At the Royal Society *conversazione*, May 6, a great deal of interest was excited by the exhibition of sixty tools and utensils of the Roman period, found together in a pit in the Roman-British city of Silchester, Hants. These included an anvil, a pair of blacksmith's tongs, hammer, axes, gouges, chisels, adzes, a large carpenter's plane, two shoemaking anvils, two plough coulters, a standing lamp, a gridiron, a bronze scale beam, and others. Many of these articles were most remarkably like similar tools of the present day, the plane, which was evidently a "trying plane," and entirely of metal, being very suggestive of a Yankee origin. It is said to be the only Roman plane found in Britain. It would be interesting to know if this particular make of plane has ever been found elsewhere. It would seem as if the metal planes introduced the last few years are merely a reversion to an old type, a kind of atavism.

— Sixteen graves have recently been uncovered at Fort Ancient, the site of the greatest of the earthworks of the mound-builders. The excavation is under the auspices of the World's Fair, and under the direction of Professor F. W. Putnam of Harvard, the field work being in charge of Warren K. Moorehead. The skeletons disclosed were those of eleven men, one woman, and four children. Five were in a good state of preservation, the others in various stages of decay. In one grave the bones were so nearly gone as to preserve only the outline in crusted ashes. In another the skull alone remained, in the jaws of which were the well-polished teeth. The skeletons were those of men averaging five feet two inches in height, the tallest being six feet two inches. The burials were from three to five feet below the surface. The skeletons rested upon hard clay. Around them had been rudely set up flat river stones, then earth had been filled in, and over all broad flat stones placed. There are evidences that the men had died in conflict. About the neck of one of the child skeletons was found a necklace of bears' teeth, and in two or three of the graves were found tomahawks and stone hatchets, but no relics of an especial value. The graves will be reconstructed exactly as found for the World's Fair exhibit of American antiquities, except that no earth will be over the skeletons.

— The House of Representatives in the new Diet of Japan, says the London *Journal of Education*, is extremely anxious to cut down the Budget, and a conflict is imminent between it and the government on this subject. Its proposals are sweeping, and if carried out would cause no little consternation in the education department. The grant for schools would be reduced from $800,000 to about half that sum. Some five years since, the late Viscount Mori, who perished by an assassin's knife on the day of the declaration of the constitution, just two years ago, established five great higher middle schools, in different centres throughout the empire, to act as feeders for the university, and to serve as a check on the growing congestion of students in the capital. These institutions are specially threatened by the parliamentary reformers, many of whom hold Spencerian views, and dislike government control in education. Generally speaking, this is a critical time for education in Japan. The rising generation is growing up

without those habits of instinctive obedience and reverence which characterized the previous civilization, and the capable teachers are all young and comparatively untried men. The question how to preserve sound morality and discipline in the schools is causing grave concern at headquarters. There is a conservative movement at full flow just now, the demand for foreigners as teachers is at ebb, the schools in most cases preferring Japanese who can help them translate. Foreign modes have never been so unpopular since the great revolution. There is a troublesome class in the capital known as *soshi*, a word which it is difficult to translate so as to convey an adequate meaning. They are not students, though so described sometimes, but rather political unattached meddlers, who would right all wrongs by the use of sword-sticks and bombs. They profess to be intense patriots, and are certainly in many cases reckless of their lives, and most deliberate in carrying out their plans. The only school in which anything of the *soshi* spirit has appeared is the Higher Middle School of Tokyo, some of the students in which have once or twice disgraced themselves.

— In the new number of the Journal of the Bombay Natural History Society, says *Nature*, Lieut. H. E. Barnes continues his interesting papers on nesting in western India. Speaking of house-sparrows, he says that no amount of persecution seems to deter them from building in a place when they have once made up their minds to it. At Deesa he found that a pair had built a large nest in the antlers of a *sambur* in the veranda. Another pair made a nest in the soap-box in the bath-room, and, although the nest was destroyed several times, they would not desist, and at last, "from sheer pity," he had to leave them alone. The most peculiar case was when a pair had a nest in a bird-cage hanging against the wall, just above where the *durzi* sat all day working, and close to a door through which people were passing in and out continually. The door of the cage had been left open, the previous occupant having been transferred elsewhere. Not only were four eggs laid, but the nestlings were reared, although the cage was frequently taken down to be shown to visitors. Once the eggs were nearly lost, a boy having taken them out. The fuss made by the birds led to the recovery of the eggs. The author has a curious note on another peculiarity of sparrows. "I have often," he says, "had to turn the face of a looking-glass to the wall to prevent them from injuring themselves, for immediately one of them catches a glimpse of himself in it, he commences a furious onslaught on what he imagines must be a rival, and, if not prevented, will continue fighting the whole day, only leaving off when darkness sets in, recommencing the battle at dawn the next day. I once tried to see how long it would be before the bird gave in, but after two days, seeing no likelihood of his retiring from the unequal contest, I took pity on him and had the glass covered up. The bird did not seem in any way exhausted, although I do not think that he had a morsel of food for two days."

— From a report of Professor A. E. Dolbear, the electrician of the Portelectric Company, we learn that during the past year experiments have been carried on at the New England Portelectric Station in Dorchester, with the view of determining the best conditions for building and operating a commercial line employing the method known as the "Portelectric," to which we have before referred in *Science*. As the whole scheme was a new one, every step was a tentative one. The oval track is 2,784 feet long, and the curves are much too short to attain the high speeds attainable on a straight line. When the car was first sent round the track, it made the circuit in about two minutes; now it has made it in fifty-one seconds. The hindrances to still swifter travel are only the mechanical ones of proper track and alignment. That this is so is evident from the fact that an acceleration of six feet per second has been observed upon the iron car, which weighs about 500 pounds; an acceleration which if maintained for thirty seconds would give it a speed of 180 feet per second — a little more than two miles a minute. The friction of the present structure is therefore the only impediment; and it is equally obvious that the strap rails used, the lack of stiffness in the beam carrying the upper rail, and the severe wedging of the wheels as they go round the sharp curves are the factors. These, of course, can be entirely remedied. The experimental car is hollow, and has an interior capacity of about five cubic feet, and is therefore capable of holding about 10,000 letters, which would weigh 180 pounds; or the space could be filled with other packages needing transportation. It is probable that a still greater capacity in the car could be had with as great efficiency in power and speed. On account of the fact that the car closes its own circuit in the coil where it chances to be, it happens that numbers of cars can be running upon the same track at once, each one taking its supply of electrical energy independent of the rest. Suppose, then, a line between Boston and New York. If the speed be, say, two miles a minute, then, if a car left, every five minutes, they would be ten miles apart. If this rate of despatching a car be maintained for all-day service, there would be $12 \times 24 = 288$ cars one way per day, and if each one's load was, say, 250 pounds, they could transport thirty-six tons per day. If the track were double, as it probably would be, it could transport twice that amount.

— On the 7th of April last, says *The Missionary Herald*, the Harris School of Science at Kyōto, Japan, was opened and the Science Hall dedicated. The building is 110 by 65 feet, with a wing for a laboratory, and has connected with it an astronomical tower. The cost was about $15,000, which, with $85,000 for endowment, was the gift of an American, who desires that scientific instruction shall be conducted under Christian influences.

— Some remarkable electrical phenomena accompanying the production upon the large scale of solid carbon dioxide are described by Dr. Hausknecht of Berlin in a recent number of the *Berichte* of the German Chemical Society, of which *Nature* of May 14 gives a brief account. In order to obtain large quantities of solid carbonic acid it is found most convenient in practice to allow the liquid stored in the usual form of iron cylinder to escape into a stout canvas bag, best constructed of sail-cloth or some such strong fabric, instead of the usual lecture-room receiving apparatus, the cylinder being inclined from the vertical so as to permit of a ready and uniform exit from the opened valve. The liquid under these circumstances issues at pressures varying from sixty to eighty atmospheres, and a compact snow-like mass of solid carbon dioxide is formed in the canvass receiver, owing, as is well-known, to the extreme lowering of the temperature of the liquid due to its sudden expansion and the accompanying absorption of heat. When the experiment is performed in the dark, the canvas receiver is seen to be illuminated within by a pale greenish-violet light, and Dr. Haussknecht states that electric sparks ten to twenty centimetres long dart out from the pores of the cloth. If the hand is held in these sparks the usual pricking sensation is felt, similar to that perceived on touching the conductor of an electric machine at work. Dr. Haussknecht further states that the phenomenon is very noticeable in the dark whenever there is a leakage in any portion of the compressing apparatus or the manometers connected therewith. The reason assigned for this development of statical electricity is similar in principle to that usually accepted in explanation of the hydro-electric machine of Sir William Armstrong. As the liquid carbonic acid is issuing from the valve it becomes partly converted into gas, which is violently forced through every pore of the canvas. Moreover, carried along with this stream of gas are great quantities of minute globules of liquid, which are brought in forcible contact with the solid particles already deposited. Dr. Haussknecht therefore considers that the electrical excitation is due mainly to the violent friction between these liquid globules and the solid snow. It is very essential for the successful reproduction of these electrical phenomena that the carbon dioxide should be absolutely free from admixed air; that prepared artificially yielding much finer results than that obtained from natural waters, which latter contains considerable quantities of air. The luminosity is not generally developed in the interior of the receiver until a crust of solid carbonic acid from one-half to one centimetre thick has been deposited, which renders the probability of the correctness of the above theory all the greater. Dr. Haussknecht has constructed a special form of apparatus, with which he is now experimenting, with the view of being able to determine the sign, nature, and quantity of the generated electricity.

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DISCOVERY OF A FRESH-WATER LAKE NEAR THE SEA OF ARAL.

ACCORDING to information conveyed to the Geographical Society of Paris by M. Edouard Blanc, and printed in the May number of the Proceedings of the Royal Geographical Society of London, an interesting discovery of a fresh-water lake to the southwest of the Sea of Aral has been made by Col. Koslowski, of the Russian geographical service of Turkestan. Up to a comparatively recent date the Sea of Aral was represented on the maps as forming at its south-west corner a deep, narrow gulf (named Aïbu-ghir), extending far into the land, and bordering on the south-east the great Ust-Urt plateau. The Russian military expedition to Khiva (1872-3), in its march round the south-west and south of the Sea of Aral, found no such arm of the sea, and since then the Gulf of Aïbu-ghir has practically disappeared from the maps. In the map which accompanies Baron Kaulbars' work on the delta of the Amu-daria, the so-called Gulf of Aïbu-ghir is shown merely as a depression, without water, and its form and position are only vaguely indicated. Recent surveys effected by Col. Koslowski have revealed the existence of a fresh-water lake, occupying very nearly the position formerly assigned to the Gulf of Aïbu-ghir, but differing in its form. This lake is quite distinct from Lake Sari Kamish, which lies to the south of the tableland of the Ust-Urt, and has recently been the subject of a special exploration by Gen. Glukhovskoi. Unlike the Sari-Kamish depression, which, except at times of great overflows of the Oxus, is mostly dry, Lake Aïbu-ghir has a permanent supply of water, being fed by a fresh-water stream flowing into it from the northeast, which, although not in direct communication with any branch of the Amu-daria, drains the marshes formed by the overflowing of that river. The probable explanation of the formation of this lake is, according to M. Blanc, that it is part of the former great Aralian basin, which has become isolated in consequence of the general and progressive desiccation which has taken place in all this region. The elimination of the salt from its waters might be due to the formation of salines, although no salt-beds under the sand round the shores of the lake have yet been discovered; or it might be supposed that at some recent epoch, during a great overflow of the Oxus, the lake basin was filled with fresh water, the salt water being driven back into the Sea of Aral, and that at the same time a bar was formed by the alluvium brought down by the river, which would prevent the salt water flowing back again into the lake. The map of Col. Koslowski also fixes definitively the contour of the south-eastern escarpment of the Ust-Urt plateau and the topography of the country to the south west of the Sea of Aral.

IMMORTALITY IN THE LIGHT OF MODERN DYNAMICS.[1]

THE hypothesis in reference to the re-grouping of atoms, in accordance with the calculus of permutations, which I announced in conclusion of my lecture on "Geological and Cosmical Problems," before the Franklin Institute, on November 17, 1890, is not entirely new, and I am bound to say that in at least one of its aspects it was advanced more than a hundred years ago by the great German philosopher Leibnitz, at a time when the sciences of chemistry and physics were not sufficiently advanced to warrant such a speculation. In the light of modern dynamics, however, it deserves our closest attention, for if it can be shown that matter is composed of ultimate particles, call them atoms, centres of force, or what we like, which are indestructible and in a state of continual vibration, I do not see how we can escape the conclusions which are forced upon us by this hypothesis. Some of the points which I am now about to discuss are new, and I am not aware that this entire subject has ever been presented in the manner in which I now propose to deal with it.

According to the nebular hypothesis our earth, like all the rest of the planets, once existed in the shape of a gas-ring, which was thrown off or became detached from the sun during its process of condensation. This ring could not retain its form: it necessarily went to pieces, and these afterwards collected into a single gas-globe, or spherical mass, which kept on pursuing its course around the great central body. The gaseous globe radiated an enormous amount of heat, it grew denser and denser, while its diameter diminished; it underwent an endless series of metaphorphoses, until it finally became the earth as we know it, the planet which has given us birth. So far all this is nothing new.

Now, even if the nebular hypothesis should prove erroneous, the conclusions which I am now about to present will remain in force, for the same ultimate conclusions can be drawn from every other world-hypothesis which has, as yet, been advanced.

Every particle of our earth, every object, every substance which we now have upon or in our earth, must have already existed in that gaseous ring or primitive gas-globe: no matter in what form or condition, it was there. In that gas-globe were the particles which, after countless ages, became united and roamed the great Mississippi valley in the shape of a mastodon; in that globe of gas were the atoms of carbon which now constitute the table on which I am writing these lines; in that immense rotating sphere were the substances which are now united in the body of my humble self.

Could we but follow, in a few days or hours, the changes, the transformations, the endless pilgrimages, which the atoms and molecules of the substances had to undergo during those æons before they became united so as to form, for instance, a human body, what marvels would we behold? The particles of hydrogen, carbon, phosphorus, etc., of which my body is composed, what a history might they not tell? In how many other bodies of the human species, of animals, plants, and inorganic compounds may they not already have existed, separated, united, differently grouped or arranged? What may they not already have gone through and experienced?

If King Solomon, wise king though he was, really pronounced, or was the first to pronounce, the opinion that there is nothing new under the sun, he could not possibly have been aware of the enormous significance which attaches to this idea in the light of modern science. Why should not the dust of Cæsar which is now filling a bung-hole, why should not those atoms and molecules which two thousand years ago were united in the body of Cæsar,—why should they not, after endless transformations, endless changes, endless transitions, become again united in precisely the same manner; in other words, why should not the same Cæsar of whom we read in ancient history, reappear at a given time: in short, why should not every thing now existing be compelled to undergo the same cycle of changes, and reappear, not once, but an infinite number of times? It would be very strange if such were not the case. The following will illustrate this.

Supposing we were to take six dice, such as are used in the

[1] Addendum to a paper on "The Limits of Scientific Inquiry" read before the Franklin Institute, Philadelphia, Nov. 17, 1890, by Dr. H. Hansoldt of Columbia College.

ordinary game. Let us place them in a little box, shake them, and throw them on the table. We will assume that they had fallen so that each cube exhibited the number three on its upper face; of course, a rare chance. Now it can be mathematically shown after how many throws those six numbers are likely to reappear according to the law of chance. It is possible that they may turn up already with the next throw; on the other hand, we may have to cast those dice ten thousand times. Both cases are improbable: the probability lies in a certain number. If, instead of six dice, we were to take seven, the critical number is, of course, so much further removed, viz: it would be necessary to throw oftener to get the seven threes, and so the number of casts increases with every additional cube, till we finally obtain enormous figures. But no matter how many dice, the threes must turn up, if we can throw them long enough, and if, in the case of a thousand dice, it were to take a million years, the threes must appear and reappear again and again after proportionate intervals.

Supposing now, that, instead of dice, we were to take a glass filled with sand. There are, let us assume, twenty thousand sand grains in the glass. Each particular grain occupies a certain position, which is bound to differ from that of all the rest of the sand grains: this the reader will doubtless admit. We shake the glass; the positions are altered, the order of arrangement is disturbed. We shake it again; the sand grains are now in a totally different position. We continue shaking the glass, and the time must come when each individual grain again occupies the exact position which it occupied when we originally started. It is a mathematical necessity, which all will admit who know anything of the calculus of permutations. The twenty thousand sand grains may be looked upon as so many dice, which are bound to fall precisely as they once fell if we can throw them sufficiently often.

Now, I have strong grounds for assuming that my body is composed of atoms, or groups of atoms, of a limited number of elementary substances, or of one elementary substance, if all matter has been evolved from one primary element. The number of these atoms may be ever so great, it has nothing whatever to do with the inevitable result. I know also that all other bodies are composed of such atoms, or groups of atoms (molecules); not only those of the human species, animals, and plants, but of inorganic substances, rocks, metals, fluids, gases; in short, of every thing which exists in, upon, or above the ground in the atmosphere. I know, furthermore, that the atoms of even the hardest and seemingly most enduring substances, such as agate and diamond, are in a state of continual vibration; that nothing can permanently retain its form; that the entire universe always has been, is now, and always will be, in a state of metaphorphosis or continual change.

The time must arrive when the atoms or molecules which are now united in my body, after countless transformations and wanderings through all kinds of bodies, substances, or intermediary stages, will once more unite in the same manner; in other words, the time will arrive when my life, like that of every other individual, will repeat itself. Yes, repeat itself, and not merely once, but an infinite number of times.

And more than this, if one of my readers should imagine that the atoms or molecules which now constitute his body, are thus associated for the first time, I can only admire his simplicity. There is nothing new under the sun. Those molecules were united in this manner before, and before this again, and 100,000,000 times previously, as far as our imagination can carry us back into the abysmal night of the æons of the past. In other words, each of my readers has been, ages ago, what he is now, has lived and gone through all this before, has felt and experienced what he now feels and experiences, down to the minutest details, has opened his *Journal of the Franklin Institute* billions of years ago and read the same lines; not once, but an endless number of times. The recollection, of course, is lost. Life and mind itself, consciousness, or "soul," is only a product of matter, and if the same substances reunite in the same manner, the same phenomena must inevitably recur.

Let the molecules which now constitute my body undergo ever so many metamorphoses, let them even — which, of course, is very improbable — once fill a bung-hole, let them be scattered about in all manner of forms and conditions, in close contact or millions of miles apart; they must come together again, may the thought please or distress me, — this is the iron logic of modern dynamics.

A JOURNEY IN COSTA RICA.

AT the February meeting of the Geographical Society of Paris (reported in the Proceedings of the Royal Geographical Society, London) a letter was read from M. H. Pittier, head of the Physico-Geographical Institute of Costa Rica. His route lay through country not previously explored from a scientific point of view. At a distance of several leagues from the capital, the traveller entered the region of oaks, which he hardly quitted for a whole week. The whole of the district known under the name of Candelaria, which, at the time of Œrsted's visit, was well wooded and rich in interesting plants, has become denuded of vegetation through the carelessness of the inhabitants, and is to-day partly covered with a poor kind of turf, over which are scattered clumps of the fragrant bushes of the "tuete" (*Vernonia brachiata*). Beyond the Rio Tarrazu the character of the country changes, and the road ascends in a zigzag line the mountain slopes, covered with forests of virgin oaks. On the summit of the Cordillera the "Paramo del Abejonal," the vast prairie which occupies the ridge of the mountain is crossed, and then a rapid descent was made to San Marcos. From the latter place to the valley of the Rio General is a journey of five days, across the great mountain of Buena Vista, the geographical importance of which has, according to M. Pittier, been overlooked, owing to insufficient exploration. Although inferior in height to the peaks of Irazu and Turialba, Buena Vista presents more sudden changes of climate and a greater variety of vegetation. The summits are almost continuously swept by a keen, strong wind, which condenses thick mists. Sleet falls frequently, and a white frost forms when the nights are clear. The immense forests, which clothe its flanks up to a great altitude, are formed almost exclusively of oaks, among which the most frequent varieties are the *Weinmannia glabra* and the *Drymis Winteri*. The vegetation of the upper region, above the forests, is alpine in character, but the bamboos were found growing beside representatives of an evidently northern flora. At one point, clearly defined formations of columnar basalt were noted. This, with other indications, led the traveller to the conclusion that the whole of the Cerro de Buena Vista is of eruptive origin, although no traces of former volcanoes were descovered. The mountain is important from a hydrographical point of view. The head waters of the Rio Reventazin occupy the greater part of its northern slope; on the west it feeds the Rios Parrita Grande, Naranjo, Savegre, and Baru; while the various branches of the Rio General take their origin from its southern flank. M. Pittier intended to cross the immense forest-covered plains extending on the left bank of the Rio General as far as the Indian villages of Terrata and Boruca, and to return to San José at the end of February. He states that the maps of all this part of Costa Rica are very faulty.

HIGH WINDS AND BAROMETRIC PRESSURE.

THE relation of high winds to barometric pressure, from observations carried out at the Ben Nevis Observatory, was the subject of a paper from Dr. Alexander Buchan, at a meeting of the Royal Society of Edinburgh on March 2, 1891, an abstract of which is given in the *Scottish Geographical Magazine* for May. This was a question, Dr. Buchan said, which had been much discussed in recent years, — some meteorologists maintaining that the influence of high winds was to depress the barometer, others that it was to raise the barometer, and several others, again, that it had practically no effect whatever. In the discussion of the Ben Nevis observations, particularly from the time that hourly observations began to be obtained from the low-level observatory at Fort William, in July last, the first question that appeared to him calling for thorough investigation was this question of the relation of the winds to the readings of the barometer, inasmuch as, till this relation be approximately determined, the proper discussion of

nearly the whole of the observations cannot be satisfactorily proceeded with. This arose from the manifest disturbing influence of high winds upon the readings of the barometer at the top of the Ben. Since the two observatories are only about four miles apart in horizontal distance they are virtually one observatory as regards geographical distribution of pressure; and as the observatory at the top was peculiarly exposed to high winds, the violence of many of which those living on the lower levels could really form no conception, while the low-level observatory at Fort William was much sheltered from winds, the two presented conditions for an exact determination of the question of the influence of winds on the barometer, from data which had not hitherto been available.

The observations at the top were made on Beaufort's wind-scale, ranging from 0, representing the calms, to 12, the greatest hurricane likely to occur. These observations had been carefully compared in connection with the registrations of a modification of Robinson's anemometer, which had been specially constructed by Professor Chrystal to meet the exigencies of observing at the top of the Ben. An elaborate comparison had been communicated by Mr. Omond to a meeting of the Royal Society some time ago, in a paper in which he had arrived at the equivalent in miles per hour for each degree of Beaufort's scale.

The next step followed in the present inquiry was to reduce the observation at both observatories to sea-level, and thereafter to enter the differences between the two barometers in columns headed 0, 1, 2, etc., of Beaufort's scale. This had been done for the six months ending January last; and as it was desirable to increase the number of observations at the higher velocities in order to obtain good averages, the observations made five times daily at Fort William from the beginning of 1885 were compared with those made at the same hours at the top of the Ben, when the wind was at 5 and other velocities up to 11. From these results monthly averages of deviations of the two barometers were deduced, with the result that in all cases a reduced barometer for the top of the hill read lower than that at Fort William, and the amount is proportioned to the force of the wind. Thus, in calm weather the Ben Nevis barometer was only one one-thousandth of an inch lower than that of Fort William, and as the velocity of the wind increased, the depression gradually became greater up to force 4, when it was fourteen one-thousandths lower. From this point it more rapidly increased, till at force 7 the depression was half the tenth of an inch; at force 9, fully the tenth of an inch; and at force 11, a tenth and a half of an inch. These differences, being exhibited in a diagram, showed a remarkable curve of depression corresponding with increased velocity of wind.

The results, Dr. Buchan pointed out, might be put to important uses in meteorology, particularly in endeavoring to establish the relation between the barometric gradient and wind velocity in storms. Hitherto this relation had been attempted to be established from the results as observed, though, it had to be confessed, with not very satisfactory results. Now, however, by applying corrections in accordance with what had been arrived at, this important practical question in meteorology could be attacked with good hopes of success. Dr. Buchan further pointed out, that, as regarded the mean distribution of pressure over the British Isles, the lower pressure hitherto determined at places on the west coast peculiarly exposed to strong winds and storms might be due, not so much to a natural depression of the barometer in these regions, as to the lowering of the barometer by the wind-force that swept past the stations where the observations were being made.

HOUSEHOLD REFUSE.[1]

THERE are 750,000 tons of household refuse produced in London every year, and the vestries are at their wits' ends to know how to dispose of it. There is a tradition that large fortunes were once made by dealing with such waste, and the "golden dustman" has passed into a proverb. But if ever this was the case, it has long ceased to be so. Either the quality of the dust has changed, or the former means of dealing with it have ceased to exist, as now it is a source of expense from first to last, and the object of all concerned in its removal is to get rid of it as rapidly and cheaply as possible.

At one time the "destructor" opened a prospect which was full of hope to the parish officials, and they grasped at the idea of burning up all the foul rubbish, and thus getting rid of it once and for all. But that time has passed. The suggestion of establishing a destructor in a district sets all the inhabitants into arms, and gives rise to an outcry that cannot be resisted. In theory the incineration of refuse is beautiful, and it can be carried out fairly well in practice, so long as the apparatus works under favorable conditions. But somehow a breakdown occurs every now and then, and the stink of burning animal refuse pervades the neighborhood. It is very easy to see how this may occur if the fires are allowed to get into bad condition. The collecting vans come in irregularly; sometimes several may arrive together, and, if the men tip their damp contents one after another into the furnaces, there is a great probability of the fires being checked and a volume of smoke given off that does not get completely consumed by the appliances provided for the purpose. Much of the evil may be due to carelessness or want of management, but whatever may be the cause, the destructor has earned for itself a bad name with the public, and it is almost impossible to establish one within the precincts of a town.

The plan that was formerly adopted of laying the refuse, or "dust" as it is called, in heaps and sorting it by female labor, requires a considerable amount of space and gives rise to nuisance. The contents of the heaps, shut out from air and light, putrefy, and when they are turned over, the stench spreads far beyond the limits of the ground. In small places this method is still pursued, but it is no longer practicable in large towns. Such places seek the readiest way of getting the dust right away. If they have access to the sea, they take it a few miles out and dump it into the water, with the result that a good deal of it floats back and litters, if it does not defile, the shore. The London vestries discharge their vans into barges and send the contents down the river to be laid on the Essex and Kentish marshes. Here there is abundant fresh air and only a spare population, so that no harm is done. In course of time nature disintegrates most of the elements of the heterogeneous mass, and when mixed with the vegetable mould of the marshes it becomes a fairly productive soil.

A cursory inspection of the contents of a dust-cart leads to the idea that they are mostly valueless and wholly offensive, or capable of becoming offensive under the influence of time and heat. But this is a mistake, due to the large bulk of the lighter and more ordurous constituents. Such articles as empty meat tins, bottles, waste paper and straw, and vegetable refuse, make a large bulk, but only weigh very little. Three-fourths of the weight of the dust collected consists of fuel. A proportion of this has never been on the fire, while most of the remainder is good cinder; it has had the gases expelled, but the carbon remains and makes capital fuel. Of course there is some thoroughly burned ash, but it is wonderful how much less than one would expect to find. The modern servant is not addicted to the use of the riddle, and all she finds in the grate in the morning goes into the dustbin. This is well known to those interested in such matters, and the brickmakers consequently absorb many thousands of tons of breeze from the dust-carts annually, to the great annoyance of their neighbors; for, although the amount of animal and vegetable refuse is relatively small, it is usually sufficient to taint all the other elements in the dust, and to render them offensive when burnt or handled.

It has been the object of sanitary reformers to discover a method by which the valuable part of the dust could be thoroughly cleaned and turned to account, and the useless parts destroyed without nuisance. A process devised for this purpose is now to be seen in active operation on the premises of the Refuse Disposal Company, Chelsea. It is the invention of Mr. Joseph Russell and Mr. J. C. Stanley, and its salient feature is that the dust is dealt with immediately it arrives, and that, during the whole time it is under treatment, it is kept in motion, and is fully exposed to the air in thin layers. It is tipped from the cart into the machine, and immediately commences its passage through the various sorting devices. In a few moments it has been divided into its different constituents, while all that is offensive has been intimately ground up with

[1] Abstract of an article in Engineering of May 15.

other material, mostly carbon, in which it is not only lost, but deodorized. The breeze and ashes find a ready sale among the brickmakers, but there is still a better outlet for them. By mixing them with pitch they can be pressed into briquettes and used for steam raising. It can scarcely be contended that these briquettes are equal to those made from fresh Welsh coal, but they are very fair, and can be sold at a reasonable price. The liquid pitch incloses any objectionable elements they may contain, and the result is that they are inodorous. Another material of value found among dust is paper. Immense quantities of this are collected, and can be used over again for the manufacture of common brown paper for wrapping parcels. After being dried to remove the dust, and passed through the beaters to reduce it to pulp, it becomes as clean and as sweet as when it came home from the grocer's or draper's. Straw can be similarly utilized for strawboards.

We recently had an opportunity of inspecting the company's premises, and feel sure that a short account of them will interest our readers. It is an important feature of the process that it is almost entirely mechanical, as nine-tenths of the material is never touched by hand. The dust as it arrives is tipped into a rotating cylindrical sieve. This runs on a horizontal axis, and is twelve feet in diameter by twelve feet long. The meshes are formed of bars three inches apart, and the progress of the tailings is regulated by an internal worm, which obliges them to make about three circuits of the screen before they can escape. A large exhaust pipe, operated by a powerful fan, draws all the floating dust and small particles forwards, and delivers them into the closed ashpit of a steam boiler. The tailings are mostly bulky articles; the paper, rags, and straw usually roll into balls, although a good deal of small escapes through the meshes. Each thing that comes out is thrown on to its proper heap, while the rubbish for which no use can be found is sent to be ground under edge runners, as will be explained presently.

The articles that pass through the meshes are raised by an elevator, and delivered to a second rotating screen fifteen feet long, six feet in diameter, and an inch and a half mesh. The tailings from this are first subjected to a blast, to take out light paper and straw, and are then dropped on to a revolving sorting table, fifteen feet in diameter. A boy sits beside it, and picks out every thing of value as it passes him, such as bottles, glass, iron, bones, etc. The rubbish, such as animal and vegetable refuse and broken crockery, he allows to go past him to the grinding mill. Here every thing for which no use can be found is reduced to a dry powder, which appears able to absorb all the offensive elements and render them sweet. There are no heaps labelled "miscellaneous" in these works to distract the manager and breed a nuisance. Every thing that is doubtful goes into the mill, which is the *pot au feu* of the establishment. When it comes out it is no longer recognizable. The mixture is carried back and put into the first screen to be again sorted.

Every thing that will pass through an inch and a half mesh falls from the second screen on to a travelling band, which delivers into a third screen fifteen feet by six feet, covered with two meshes, half an inch and three-eighths of an inch. What passes through the former is called ashes, and through the latter breeze. The tails go for steam generating. The ashes are used to mix with clay for brickmaking, and the breeze for burning in the clamps, unless, as indicated above, they are pressed into briquettes, which, of course, fetch a better price. The ashes and breeze pass over a fine shaking-screen, which takes out every thing below an eighth of an inch. This is valuable as manure, being the greater part of the animal and vegetable matter ground up in the mill.

Having traced the dust through its entire passage we must return and notice some of the tailings. As we have already said, every thing for which an immediate use cannot be found is destroyed. At present straw falls into this category, although the success of foreigners in the manufacture of straw-boards leads to the hope that that manufacture may be eventually established here. The straw is all burnt with special precautions to render the smoke inoffensive. An externally fired cylindrical boiler has two grates; on the larger of these the straw is burned, while on the smaller there is a breeze fire through which the gases from the straw are passed to complete the combustion. The paper is re-made on the premises. This seems a curious industry to carry on in Chelsea, but a well has been sunk into the gravel, and an ample supply of water has been obtained to keep three beaters and one paper machine at work. This is the most valuable by-product of all. The special value of the process is, however, that it enables the paper to be cleansed immediately, instead of being retained until a market can be found for it.

The works naturally consume a good deal of steam, particularly for the paper-making, and this accounts for much of the fine fuel. Indeed, it is conceivable that in any general extension of the system it might be worth while to use all the fuel on the premises in winter for the production of electric lighting currents. The total cost of handling would thus be avoided, and possibly a saving of the ratepayers' money effected. To prevent the evolution of smoke and any nuisance that might arise from the nature of the fuel, the five boilers of the works have their smoke drawn by an exhaust fan through scrubbers, in which it is thoroughly washed before it is delivered into the air. The three locomotive boilers are worked with forced draught, by which all the floating dust collected from various parts of the works is thoroughly burned up.

The works have already been in operation for nearly two years, and during that time they have grown up to the present state as the results of prolonged experiments, in the course of which five thousand loads have been treated. Difficulties, often quite unexpected, have been found and met, and new devices have had to be produced as time went on. At present the works are dealing with thirty-five loads a day from Kensington and Westminster parishes, and are on a sufficiently extensive scale to show what the process will do. They are exciting a great amount of attention all over the country, and many parishes are watching them with interest. The disposal of dust is undoubtedly one of the greatest problems of the day, and the process patented by the Refuse Disposal Company solves the question from a sanitary point of view, but of course it would want an examination of their books to decide the exact economic value of the process.

HEALTH MATTERS.

Pathogeny of Diabetes.

BOUCHARD has stated that there are no fewer than twenty-seven theories of the cause of diabetes. None are entirely satisfactory. The most important fact discovered in recent years, says the *British Medical Journal*, is that diabetes follows extirpation of the pancreas in animals, and numerous clinical observers have since then noted pancreatic disease in conjunction with glycosuria. V. Mering and Minkowski, with most praiseworthy scientific reserve, have abstained from formulating any theory to explain the undoubted fact they have put upon record, and Lépine has discovered an additional fact in relation to pancreatic extirpation and diabetes, which must be taken into account when the true explanation of these phenomena is forthcoming. Healthy blood possesses what he terms glycolytic powers. Fresh blood contains a certain percentage of sugar. If the same blood be allowed to stand at the body temperature for an hour before it is examined, a very considerable portion (20 to 40 per cent) of this sugar has disappeared. This number (20 to 40) may be taken as the glycolytic power of healthy blood.

It is considered that this sugar-destroying power is due to a ferment present in the corpuscles, but especially in the white corpuscles, as the glycolytic power of the chyle is as great as that of the blood, and the portions of the blood richest in leucocytes are richest in the ferment, which may be dissolved out from them by salt solution. In cases of diabetes the glycolytic power of the blood falls to 5, 2, or even 1. In animals without a pancreas there is a similar drop. The pancreas thus appears to be the chief source of the ferment.

Lépine believes that the activity of a pancreatic cell is bipolar; by its internal extremity it pours the pancreatic juice into the ducts of the organ, and by its basal extremity it pours into the venous blood and lymph the glycolytic ferment. The absence or

diminution of the sugar-destroying power of the blood dependent on pancreatic extirpation or disease is thus a factor, and perhaps an important one, in the causation of an over-abundance of sugar in the blood, and will certainly have to be reckoned with before the true pathogeny of diabetes is understood.

Effects of Tuberculine on Monkeys.

M. Henocque has recently tried the effect of tuberculine on a monkey which presented no symptoms of pulmonary phthisis. Two days after the first injection, according to the *British Medical Journal*, the animal, which had exhibited the characteristic re-action, presented dullness and a few *râles* at the right apex. After the third injection the dullness was more marked on the right side, and began to be perceptible at the left apex. Soon all the symptoms of acute phthisis manifested themselves, with intense fever, the animal dying ten days after the last injection, after losing a tenth of its weight during that time. The total amount used was six milligrammes of the diluted fluid. On post-mortem examination, four tuberculous nodules of the size of a pea were found in the right lung, and caseous pneumonia involving two-thirds of the organ in the left. In both cases the tuberculous lesions were surrounded by a zone of very intense red hepatization. Pieces of the caseous tissues were injected into two guinea-pigs, in one after mixture with sterilized water, in the other with diluted tuberculine. Both animals showed signs of cutaneous and glandular tuberculosis.

A New Antiseptic.

At the Académie de Médecine, Paris, on April 28, M. Polaillon read a paper contributed by Dr. Berlioz of Grenoble on a new antiseptic agent called "microcidine," which is composed of seventy-five per cent of naphtholate of sodium and twenty-five per cent of naphol and and phenyl compounds. According to the *Lancet*, it is a white powder obtained by adding to fused β-naphthol half its weight of caustic soda, and allowing the mixture to cool. It is soluble in three parts of water, and the solution, which is cheap, is said to possess considerable antiseptic powers, without being toxic or caustic, or injurious to instruments or linen. The antiseptic properties of microcidine, while inferior to those of corrosive sublimate or naphthol, surpass those of carbolic and boracic acids ten and twenty times, respectively. Microcidine is eliminated by the kidneys, and is antipyretic. M. Polaillon has experimented with this new agent largely as a dressing to recent and other wounds, utilizing as a dressing, after a preliminary cleansing of the raw surface with a three per cent solution, gauze soaked in the same and covered with a layer of oil silk and a thick pad of cotton-wool. The results are reported to have been excellent.

LETTERS TO THE EDITOR.

*** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Electric Storms and Tornadoes in France on Aug. 18 and 19, 1890.

ON the very day of the tornado at Wilkesbarre, Penn., last year, another, almost unprecedented, was raging at St. Claude, France, near the Swiss frontier, south-east from Paris. On the previous day electric storms and very strong wind-rushes, perhaps tornadic in their character, devasted other portions of France. In the reports of these violent storms there is a continual mention of their similarity to the tornadoes in this country. Quite full accounts by several prominent physicists have appeared in *Comptes Reudus*, and these will be freely quoted from.

On Aug. 18, 1890, at 7.15 P.M., a *trombe* (this word is used for water-spout usually, and seems to indicate, on land, a funnel cloud but of somewhat narrower dimensions than those in this country) struck the commune of Piré, situated in Ille-et-Vilaine, and about 180 miles a little south of west of Paris. It moved to the north-east, and next struck Domagné, 3.5 miles from Piré. The length of its track was about 10 miles, and width 650 to 870 yards. Its velocity was almost 37 miles per hour.

A second *trombe* struck Dreux, situated 45 miles west of Paris, at 10.25 P.M.; then it passed north-east to St. Thibault, and on through the Blaise valley to Fontaine, about one mile from Dreux. It then turned to the left in the valley of the Eure River, and again turning to its former course, it struck Brissard.

On the next day a *trombe* struck St. Claude, at the eastern boundary of France, at 7.37 P.M. It moved north-east 15.5 miles to Brassus, then to Bris-d'Amont, and to the station Croy, which it reached at 8.37 P.M. The velocity was 42 miles per hour, and the width of destruction 220 to 1,100 yards.

These facts show clearly that there were several violent storms on the 18th running in parallel lines, beginning toward the west early in the evening and occurring at points farther east later on; that is to say, the several appearances near Piré and Dreux were separate occurrences, and the violent storm did not go from one to the other, but each devastated its own narrow strip. It will be seen that this bears a most remarkable resemblance to the action of tornadoes in this country.

At Piré the *trombe* was investigated by M. G. Jeannel. There was an apparent whirlwind, transported parallel to itself, and turning counter-clock-wise, as shown by the fallen trees. The first thrown down were from the south-east, the next from the east, and so on to the north-west. The greater damage was on the right hand of the track. The velocity of gyration was great and that of translation relatively much less.

The roofs damaged were peculiar. On the right of the path those facing north were carried away, while those facing south were unharmed; on the left of the track just the reverse was true. During the whole time the lightning was continuous. The odor of ozone was noted at different places. At Reinou a woman tending a cow, grazing in the meadow, saw her enveloped in violet flames. These were so intense that the woman, from fright, covered her face with her handkerchief. A moment later the wind struck down every thing.

At Domagné Dr. Pettier suddenly heard an extraordinary indefinite roaring. He rushed toward the garden, where the firs were being plucked up. At the gate he felt a kind of pressure from above; he noticed an unusual smell of ozone; then he felt himself raised up, and this not by the wind, for it was calm, but as though by some invisible force. On many trees the foliage was scorched. About a mile west of Domagné, hail of the size of a walnut fell to a depth of over three inches, covering the ground.

At Dreux the report was by M. Bort. At 10 P.M. a great cumulo-nimbus thunder-cloud was seen to the south-south-west of the town. On its upper part a very brilliant plume of sparks was directed toward heaven. In this cloud the lightning was incessant and the thunder loud. After some hail had fallen, at about 10.25 P.M., a loud roar was heard, like that of a train entering a tunnel, and in less than a minute the storm reached the town. It blew off the tiles, plucked out the trees, and destroyed many houses. At the moment of the passage the sky was on fire, and some persons saw a cloud which reached the height of a house. Reaching the Blaise valley it plucked up many poplars, and left them lying generally from south-south-west to north-north-east. In the environs of Fontaine many trees were uprooted. At Brissard the hurricane made a passage through the western part of the village, destroying twenty houses. At another point most of the trees lay from south-west to north-east, but there were many, 220 yards from the first, that lay in an opposite direction.

Lightning strokes were very rare, because no traces were found upon trees, and no houses were fired. There was a remarkable exception, however, in the Vivien house, built solidly of brick, which had traces of electric discharges. Some window-panes were pierced by circular holes, and these holes had a sharp edge on the outside. On the inside the edge had suffered a beginning of fusion, which had rounded it off. The damage was reported at $800,000 in Dreux, and one person was killed. At the instant of the passage all the gas-lights were extinguished, and it is suggested that "this indicated a rarefaction of the air near the centre of the whirl." By the synoptic charts it appears that the passage of this *trombe* was coincident with the existence of a secondary

barometric depression in the west of France, its path being recognized from Vendir to Ardennes.

The tornado at St. Claude, on the 19th, was studied by M. Cadenat. The giratory movement was recognized by prostrate trees, by pieces of board, *débris* of roofs, etc. On the right of the track many trees were blown down toward the north-east. On the left less trees were uprooted, and some lay in an opposite direction. In some places trees were blown down at right angles to the track, their roots invariably to the right. At some places bunches of trees were left intact in the centre of the tornado's track. The whirl was counter-clock-wise. "This trombe-cyclone in its narrowness furnishes the character of a *trombe* or tornado, and in its whirling, of a cyclone. I give the following secondary phenomena in the order of importance: —

"(1) The liberation of considerable electricity.

"(2) The straight currents.

"(3) The division of the principal branch.

"(4) The funnel-shaped cloud.

"(5) The aspiration.

"(6) The lateral wind."

"At 8 P.M. the sky is like a vast conflagration; the air is calm. Some great drops of rain, some few hail-stones, very great (40 grams), formed of agglomerated grains, preceded the disaster. A lightning stroke fired a house at Bois d'Amont (Jura). At the Swiss frontier the people saw fire on all sides. At another place globular lightning was seen. Some people were killed by lightning strokes. On all sides was a smell of ozone. Walls were prostrated, holes bored in window-panes, stoves destroyed, keys and bars of iron twisted, etc. On all sides thunder-bolts were very evident from their mechanical effects.

"We see on the left and right of the track through a forest, and in front of each point struck by a thunder-bolt, trees thrown down in great number, the top directed against (*contre*) the point struck. The direction of some fir-trees was perpendicular to the path.

"The funnel-cloud, thanks to numerous and intense lightnings, was seen by an observer at Aigh, some 35 miles from the tornado. The aspiration produced by the whirl was shown by the transport to 300 and more yards of great and solid *vachers*, by the removal of roofs, by the plucking up of a heavy boundary-stone weighing a hundred pounds, by the transport of objects 31 miles, mostly to the north. Hail fell at more than two miles to the north-west."

M. Faye also received a private report from M. Cadenat, and remarks: "It is very remarkable that in the United States tornadoes are rarely accompanied by electric balls similar to those at Dreux or at St. Claude, or at the ancient tornadoes of Assonval (1822) and of Chatenay (1835)." He thinks this is because they occur here mostly in daylight. He also suggests that the mechanical action of tornadoes is well understood to-day.

I note (1) there seems to be an enormous variety of terms which are applied in France to phenomena of this kind. In the four reports, covering eleven pages, the following are noted: *coup de vent*, used 6 times; *cyclone*, 6; *meteor*, 11; *orage*, 13; *ouragan*, 9; *tempete*, 4; *tourbillon*, 12; *tourmente*, 1; *tornado*, 19; *trombe*, 13; *trombe-cyclone*, 2. The fact that "tornado" heads the list in frequency is significant.

(2) It is hardly probable that there was a diminution in the gas pressure at Dreux through a diminished air pressure. A similar fact was noted at Cleveland, O., when there was no tornado, and at Louisville, Ky., during the tornado last year. An investigation of this question has shown that the diminished pressure is due to the forcing of the gas-holder at the works, by the wind, against the upright posts (see "The Tornado," p. 136).

(3) It is hardly probable that the absence of the observation of fire-balls in the tornadoes in this country is due to the light of day hiding the appearance. At such a time the sky is black, and the light is sufficiently diminished to show any bright, fiery object. The lack of this observation is due, partly to its not having been investigated, partly to the fact that most every one seeks safety in a cellar or dug-out, where it cannot be observed, but mostly, I think, because in the severer tornadoes the electric action, while abundant, does not manifest itself in this way. We are but just beginning to learn about unusual manifestations of electricity in storm phenomena. One of the most recent utterances is this, regarding the action of a lightning flash: "The seat of the electrical energy is, and must be, not in the cloud or in the earth, just preceding a flash of lightning, but in the air column between cloud and earth" (*American Meteorological Journal*, April, 1891, p. 599). If it can be once proved that it is possible to intensely electrify a column of air, we shall have gone a long way toward determining the cause of our funnel-clouds and the destructiveness of the tornado. It should be noted that fire-balls were observed at Louisville ("The Tornado," p. 134).

(4) I think we have hardly made a beginning in a determination of the causes of the mechanical effects noted either in our general storms or tornadoes. I can do no better than close with a quotation from "Bay of Bengal Cyclone Memoirs, Part III.," just received in this country..

The author, Mr. Eliot, himself an ardent supporter of the ordinary condensation theory of storms and tornadoes, by a course of reasoning almost identical with that previously adopted in this country, has arrived at the following conclusion, on page 285: —

"A cyclonic circulation cannot be resolved into the translation of a rotating disk or mass of air. The fact that the main supply of the energy is applied in front of the cyclone suggests that it is perpetually renewed in front, and that in fact its motion and transmission are hence rather to be explained by some process analogous to the transmission of a wave." This may be regarded as a noteworthy corroboration of views seriously antagonistic to present theories, and seems to indicate a significant advance in theories of storm generation. (See also in this connection this journal, No. 428, p. 150, and *Scientific American Supplement*, Jan. 18, 1890.)

(The following journals have been consulted in making up the above paper: *Comptes Rendus*, Aug. 20, 1890; Sept. 15, 1890; Oct. 6, 1890; Dec. 22, 1890; *Das Wetter*, December, 1890; April, 1891; and *American Meteorological Journal*, April, 1891.)

H. A. HAZEN.

Washington, D.C., May 22.

BOOK-REVIEWS.

Our Common Birds, and How to Know Them. By JOHN B. GRANT. New York, Scribner. Oblong 12°. $1.50.

THIS is an attractive little volume which cannot fail to interest any one who loves nature and to be helpful to him who wishes to become intelligent upon our common birds.

To quote from the modest introduction: "The author desires to disclaim great scientific knowledge of birds and their ways, his object being not so much to impart information as to point his readers to the way of acquiring it for themselves." It becomes quite evident, however, that Mr. Grant can tell us much more than he does, when we have mastered the first steps.

Some seventy portraits of birds on separate plates are given; the significant characteristics of each are so closely brought out, that, in connection with the text, it makes identification of the real object a comparatively simple matter.

The writer succeeded, during one hour spent in a small thicket a few hundred feet from his house, in New Jersey, in matching bird and picture of about a dozen specimens.

The book is of convenient size for carrying about, and would be as valuable an addition to the library of every school boy and girl as it is interesting to any one who, in his love of nature, "holds communion with her visible forms."

Appletons' School Physics. By JOHN D. QUACKENBOS, literary editor; ALFRED M. MAYER; FRANCIS E. NIPHER; SILAS W. HOLMAN; FRANCIS B. CROCKER. New York, Cincinnati, Chicago, American Book Company, 1891. $1.20.

THE title of this book shows what place it is intended to fill, and the list of authors shows how earnestly the publishers have attempted to make a book that shall fill that place with satisfaction. The literary editor, Dr. Quackenbos, is a professor of English at Columbia College, and is a member of the New York Academy of Sciences and a fellow of the New York Academy of Medicine. To each of the four scientific men whose names follow that of Dr. Quackenbos on the title-page has been assigned a special department of physics. Professor Mayer of the Stevens Institute,

so well known for his works and investigations on sound, treats of that subject; Professor Nipher of Washington University, St. Louis, gives the chapters on heat, light, and the principles of electricity; Professor Holman of the Massachusetts Institute of Technology gives the introductory portions on matter and motion; and the applications of electricity and magnetism are handled by Mr. Crocker of the School of Electrical Engineering of Columbia College. It is needless to say that these are all men prominent in their several departments.

It would naturally be possible that an honest difference of opinion should exist as to the best way of presenting physical problems to young minds, but throughout this book we find evidences of an earnest purpose by competent men to do this according to their best judgment, and we believe the book is destined to do great good in our schools. The amount of apparatus required is not excessive, and the amounts of descriptive matter and experiment seem well balanced.

AMONG THE PUBLISHERS.

IN the *New England Magazine* for June there is an interesting illustrated article on the "Early Days of the First Telegraph Line," by Steven Vail.

— "Not to the Swift" is the title of an entertaining novel from the pen of Lewis H. Watson, just published by the Welch, Fracker Company of this city (400 p., cloth, $1.25). The scene is laid in this country, about the time of the Rebellion, some of the plots connected with that event being woven into the fabric of the story, and one of the plots, at least, being given an entirely new and somewhat startling significance in the process of weaving.

— There has recently been issued by the Missouri Botanical Garden, St. Louis, a report on "The Species of Epilobium occurring North of Mexico," by Professor William Trelease.

— To the June *Atlantic* Professor George Herbert Palmer contributes "Reminiscences of Professor Sophocles," who was professor of Greek at Harvard University for nearly forty years, — a simple and Homeric figure, caring nothing for outward forms and fashions, and with his thoughts oftener in Arabia than Cambridge, drawn from a monastery to give himself up to what he called "the ambition of learning." College men will be also deeply interested in Mr. S. E. Winbolt's paper on "Rowing at Oxford." In the same number President D. C. Gilman of Johns Hopkins University has a paper on "The Study of Geography," and its place in the college course.

— The first of a series of descriptive and illustrated quarto memoirs on the *Vertebrata* of the Tertiary and Cretaceous rocks of the Canadian North-west Territory, prepared by Professor E. D. Cope of Philadelphia, has just been issued by the Geological Survey of Canada. It is exclusively devoted to a consideration of the species from the Lower Miocene deposits of the Cypress Hills in the district of Alberta, and consists of twenty-seven pages of

Publications received at Editor's Office, May 20–26.

GEOLOGICAL Survey of New Jersey. Annual Report of the State Geologist for the Year 1890. Trenton, Murphy, pr. 305 p. 8°.
PROFITABLE Advertising. Vol. I. No. 1. *m.* Boston, C. F. David. 32 p. 8°. $1 per year.
VERNON-HARCOURT, L. F. Achievements in Engineering during the Last Half Century. New York, Scribner. 311 p. 8°. $1.75.
WALLACE, A. R. Natural Selection and Tropical Nature. London and New York, Macmillan. 492 p. 8°. $1 75.
WATER Commissioners of the City of Taunton, Mass., Fifteenth Annual Report of the. Taunton, Hack, pr. 67 p. 8°.
WEST Virginia Agricultural Experiment Station, Third Annual Report of the. Charleston, Donnally, pr. 185 p. 8°.

letter-press, illustrated by fourteen full-page lithographic plates. Part 2, which will contain illustrated descriptions of the vertebrates of the Laramie formation of the North-west Territory, by the same author, is now in course of preparation.

— The American Society for the Extension of University Teaching will shortly issue the first number of *University Extension*, a journal devoted to the interests of the movement for popular education known as university extension, which has taken such a strong root in this country at many centres. The periodical will serve as the organ of the society, and will constitute a general depository of information relating to the subject, and will be devoted to arousing and sustaining a public interest in all that pertains to this branch of popular education. All communications should be addressed to the society, 1602 Chestnut Street, Philadelphia.

— John Burroughs's "Talk about Wild Flowers," in *St. Nicholas* for June, will show botanists how to make their science "understanded of the people," and may also suggest to them a few particulars upon which fuller information is desirable.

— The eyes of travellers and pleasure-seekers who are weary of the beaten paths are just now turned towards Alaska, which is said to possess some of the most marvellous scenery in the world. An article describing a trip to Alaska and the beauties of its mountains and valleys is contributed to *Lippincott's Magazine* for June, by Grace Peckham, M.D.

— The "Third Biennial Report of the California State Board of Forestry" contains a monograph, with thirty illustrations, of the cone-bearing trees of the north-west, including California. Persons desiring corrected copies can obtain them by sending 10 cents per copy (to cover expense of wrapping, postage, etc.) to J. G. Lemmon, botanist of the board, 1015 Clay Street, Oakland, Cal. A few copies remain of the previous report describing the "Pines of the Pacific Slope," with twenty-four illustrations.

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SCIENCE

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NINTH YEAR.
VOL. XVII. No. 435.

NEW YORK, JUNE 5, 1891.

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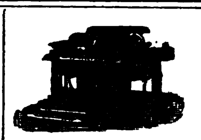

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SCIENCE

NEW YORK, JUNE 5, 1891.

FLAX CULTURE IN RUSSIA.

FLAX is cultivated in all parts of European Russia for local consumption, but, according to a recent report by the United States consul at Odessa, it has an importance for manufacture only in twenty-three governments, which sow more than 3,105,000 acres in flax, the remaining twenty-seven governments sowing less than 675,000 acres. With regard to the object for which flax is sown, European Russia can be divided into two regions, the northern and the southern. In the first flax is sown chiefly to obtain the fibre, although with the fibre seed is also obtained, and in the second nearly exclusively for the seed. The northern region of the cultivation of flax for manufacturing purposes extends from the south-eastern part of the Baltic Sea to the central part of the Ural Mountains, within which are the governments of Livonia, Kovno, Vilna, Vitebsk, Pskov, Smolensk, Tver, Yaroslav, Vladimeer, Nijni Novgorod, Kostroma, Vologda, Viatka, and Perm. More flax is cultivated in the governments of Viatka and Pskov than in the others. In the first about 251,000 acres are sown in flax, and in the second about 221,000 acres. These two provinces may be considered as the centres of the cultivation of flax, around which the other flax-producing provinces are grouped. The yield of flax per acre in these provinces is very different, and depends on the quality of the soil in which the flax is sown. An acre of good land gives 400 pounds or more of fibre and from 400 to 535 pounds of seed, but an acre of poor, exhausted soil will not yield more than 160 to 200 pounds of fibre and about 265 pounds of seed. The average yield for the entire region may be considered to be from 265 to 330 pounds of flax fibre and 400 pounds of flaxseed per acre.

The southern region of the cultivation of flax for the sake of the seed consists of the following territory and governments: The Don-Cossack territory, sowing 262,000 acres; Yekaterinoslav, sowing 251,000 acres; Kherson government, sowing 175,000 acres; Taurida (Crimea), Samara, Saratov, Voronezh, Tambov, and Poltava. In the last two provinces flax is grown both for the seed and fibre. Flax for the seed is mostly sown either in virgin soil or in old fallow lands. The yield of seed in this region varies from 400 to 670 pounds and more per acre, and, for an average, may be estimated to be about 535 pounds per acre. The total harvest of flaxseed for all of European Russia attains to about 1,800,000,000 pounds. Considering the average value of the flax fibre to be $186 per ton, and that of the seed to be $44.10 per ton, it will be seen that the value or gain to Russia from the cultivation of flax is about $112,000,000 annually.

The advantages derived from the cultivation of flax would be far more if the qualities of the Russian fibre would correspond with its quantities, and if a larger portion of it were to be exported in a manufactured state. As regards its quality, Russian flax is not only surpassed by Irish flax, but also by flax of many other countries of western Europe (Belgian, Dutch, French, and Bohemian), and is valued in foreign markets lower than any other flax. The low qualities of the Russian fibre are not the results of natural causes, but of the ignorance as to the proper method of treating the flax. The cultivators of flax are chiefly peasants, who partly do not know, and partly do not possess the means to acquire, the latest improvements in the primary technical manipulation of the fibre. Another cause of the imperfect working out of the flax is to be found in the absence of a home demand for a high quality of fibre. Russian factories do not produce linen from the finest numbers of thread, and therefore do not require the highest class of flax. This latter circumstance is unfortunate, as it is a strong impediment to improvements in the manipulation of the flax fibre.

The aim of the producer is a large quantity rather than an improved quality, and the result is a progressive reduction in the fibre. Of late years this has become particularly apparent in the government of Pskov. Formerly Pskov flax had a high reputation all over Russia, but now it is quoted much lower than flax from Velogda, Kostroma, Yaroslav, and Tver. About one-half of the flax fibre produced in Russia is exported abroad only half worked (the unbrushed fibre together with the tow), and the greater part of the fibre remaining in the empire is worked up by the peasants in their farmhouses into thread and linen for their own use, as well as for sale. A much smaller part of the flax goes to the spinning and weaving factories, which are chiefly situated in the governments of Vladimeer, Kostroma, and Yaroslav.

As regards the internal or home trade of flax, it is almost entirely in the hands of small dealers, who drive from village to village and make their purchases in small lots. The flax thus collected is then sent in considerable quantities to the towns which serve as centres to the flax trade.

The *Linum usitatissimum vulgare* and *crepitans* are being cultivated in Russia in several varieties of both kinds, but the difference in these varieties is so slight and they so easily blend that even those initiated in the trade of the article often fail to perceive it. Both have blue blossoms and occasionally white blossoms. The blue-blossom varieties are preferred. About 21,000,000 bushels of seed are annually raised in European Russia.

Flaxseed, as understood in Russia, comprises sowing seed and crushing seed. The first named is a more carefully sorted quality, exported exclusively for sowing purposes. Crushing seed is the surplus seed of the flax plant, which is exported for making oil, etc., as there is no demand for it as sowing seed. With this quality the seed received from the interior is mixed and the whole exported as crushing seed. Of the total quantity exported, viz., 18,000,000 bushels, about two-thirds is described as sowing seed.

The seed is sown in April, May, and early in June. It is sown earlier in the south and south-east than in the centre, west, and north; much depends on whether the seasons are early or late. The harvest begins as early as July and as late as August and September, earlier in the south and later in the north. The number of bushels of flaxseed raised per acre depends on the object to be attained; when the seed is the object, a much less quantity is sown per acre, and when the fibre is desired, a much larger quantity is sown. In the south and east of Russia a little over a half bushel per acre is sown, and the yield is about ten bushels. In those parts of central Russia where the fibre is not utilized, a little over four-fifths of a bushel is sown, and the yield is about ten bushels. In western Russia and those parts of central Russia where the fibre is utilized, a bushel to a bushel and a half per acre are sown, and about five bushels is the yield. In northern Russia, where the fibre is the chief consideration, nearly three bushels per acre are sown, which gives about six bushels of seed and from three hundred to six hundred pounds of fibre.

Flaxseed is usually sown by hand, and the land should be carefully prepared and be of good quality. The ploughing should not be less than nine inches in depth, and the land should be as free as possible from weeds, and thoroughly prepared beforehand for the reception of the seed. After the sowing, the seed is covered by passing a harrow once or twice over the ground. Moist and mild weather favors the development of the plant in all of its parts; a hot and dry climate, with occasional showers, will produce a good development of the seed, but the fibre is usually coarse and brittle, as the lignin parts of the stems then develop at the expense of the fibre. The cultivation of flax, whether for seed or fibre, requires for its proper development a rich and black loam (ten to fourteen inches) having a clay subsoil. Good crops, however, are grown whether the subsoil is gravel or gray sand.

The lesson to American farmers, especially those of the North-west, which the total product of the cultivation of flax in Russia furnishes will be readily appreciated and understood. The possibilities which the cultivation of the flax fibre offers to Western farmers is only equalled by the surprise that such possibilities have thus far been neglected. The seed has been cultivated with more or less satisfactory results in the United States, but the fibre practically not at all. The climate, soil, and conditions generally throughout the North-west are very favorable to the cultivation of the flax fibre as well as the seed. After a short experience, as to the primary manipulation or handling of the flax fibre, our farmers would produce flax which would compare favorably with the best varieties of the fibre. It seems strange that a practical people like ourselves should for years have been satisfied to cultivate flax for the seed at a value of about fifteen dollars per acre, and at the same time allow six hundred pounds of flax fibre per acre to rot on the ground, this flax fibre having a value, after being manipulated, of $186 per ton.

Familiar as our farmers are with the working of improved and expensive agricultural machinery, and the latest developments of the human intellect as applied to the soil, they may always learn something by watching the working of rude ideas as seen in a primitive and unsophisticated people. The main difference between the old and the new system of farming is not one of method, but of expense; and, as physicians never really know what a disease is capable of until they see an outbreak in virgin soil, so it is not possible to fathom all the possibilities of the most commonplace notions and devices until we see them applied with the unconventional freedom and simple directness that belong to comparatively primitive peoples. The Russian peasant is both simple-minded and ignorant. He clings to old methods as much from liking as for the expense which new methods involve. From the flax fibre, by the aid of his primitive and rude contrivance, the Russian peasant produces linen, thread, crash, and other valuable and necessary articles for the use of his family and for sale. It does not require the aid of expensive machinery to make the flax fibre either useful or valuable. The rude machines which the Russian peasant employs are the handiwork of some village carpenter or wheelwright, and are made at a comparatively small cost. If the Russian peasant farmer accomplishes such results, the American farmers, who possess like conditions of climate and soil, should accomplish much more.

The unsatisfactory condition of our farmers in our north-western States, which is certainly due to the overcultivation of wheat, with its yearly decreasing yield per acre, renders it all the more important that a speedy means be found to relieve a condition of things which affects the material interest and welfare of the great majority of the people of the United States. Such a means exists in the flax plant. It will not only enable farmers to make their own linen, rope, thread, crash toweling, oil cake, and much besides, but will cause new industries to be established throughout the country in districts where the advent would be both profitable and new. There should be a general and persistent effort made to encourage the cultivation of the flax fibre throughout the United States, with the view of establishing factories for the manufacture of twine or textiles, and, if our consul's report should develop a proper interest in so important a subject, the result can not fail to be satisfactory.

HEALTH MATTERS.

The Anæsthetic Action of Nitrogen.

WHILE some writers maintain that the anæsthetic action of nitrous oxide is due to its preventing access of free oxygen to the system, others believe that it has a "specific anæsthetic action." It occurred to Dr. G. Johnson (*Lancet*, April 11) that some light might be thrown upon this subject by the administration of pure nitrogen. Accordingly he obtained a cylinder containing 100 cubic feet of compressed nitrogen, in which the proportion of oxygen present was only 0.5 per cent by volume, with 0.3 per cent of CO_2. As a preliminary trial, Mr. F. W. Braine administered this gas in five instances to members of the staff of King's College, who volunteered to submit to the experiments. The result was in each case the production of complete anæsthesia and of general phenomena precisely similar to those observed from the inhalations of nitrous oxide. Encouraged by these results, Mr. Braine felt justified in administering the gas to patients at the Dental Hospital for anæsthetic purposes. Nine patients took the gas. In every case the result was the production of complete anæsthesia, with general phenomena similar to those observed during nitrous oxide inhalation. The pulse was first full and throbbing, then feeble. In the advanced stage the respiration was deep and rapid, and there was lividity of the surface; the pupils were dilated, and there was more or less jactitation of the limbs. The only difference, in the opinion of some of those present, being that the anæsthesia was less rapidly produced, and somewhat less durable, than that from nitrous oxide, though in each case the tooth was extracted without pain.

On a subsequent occasion the same gas was administered by Dr. Frederic Hewitt at the Dental Hospital. As before, nine patients took the gas, The maximum period required to produce anæsthesia was 70 seconds, the minimum 50 seconds, and the mean time 58.3 seconds. In one case two teeth were extracted without pain. In one case only was pain experienced, and in that case, the tooth having been broken up and not extracted, the patient said she felt a "smashing up."

Having on several occasions witnessed the administration by Dr. Hewitt of nitrous oxide mixed with ten per cent by volume of oxygen, with the result of producing anæsthesia without lividity or jactitation, Dr. Johnson determined to try a mixture of nitrogen with a small proportion of oxygen. He therefore obtained from the same source of supply a cylinder containing forty cubic feet of nitrogen mixed with three per cent by volume of oxygen, and a second cylinder equally charged with a mixture of nitrogen with five per cent by volume of oxygen. These gases were administered by Dr. Hewett to patients at the Dental Hospital with the following results. In the case of the three per cent gas, which was given to five patients, the time required to produce anæsthesia varied from 60 to 75 seconds, the average time being 67.5 seconds. In each case the tooth was extracted without pain, the duration of anæsthesia being somewhat longer than with pure nitrogen. In each case there was lividity, dilatation of pupils, and more or less jactitation. On the same day Dr. Hewitt gave nitrogen with five per cent oxygen to four patients. With this mixture the time required for the production of anæsthesia ranged from 75 to 95 seconds, the average being 87.5 seconds. In each case there was complete anæsthesia, during which one patient had three molars extracted, and, although she said she "felt the two last," the sensation appears to have been that of a pull, and not of acute pain. In all of these four cases there was slight lividity before the face-piece was removed, but in only one case was there slight jactitation of the limbs. The other three patients were perfectly quiescent.

The experiments here recorded suffice to prove that nitrogen, pure or mixed with a small proportion of oxygen, is as complete and apparently as safe an anæsthetic as nitrous oxide. It is to be hoped that those who are engaged in the administration of anæsthetic gases will investigate this interesting subject further, with a view to ascertain whether atmospheric air, partially deprived of its oxygen, may be advantageously substituted as an anæsthetic for nitrous oxide.

Treatment of Phthisis.

According to the *Lancet*, Dr. Germain-Sée, in his new method of treating phthisis, shuts his patient up for two, three, or more hours daily in a hermetically closed metallic chamber, into which is slowly admitted a current of compressed air, which, having passed through a mixture of creosote and eucalyptol, is saturated with the vapor of these substances. Since August last ten cases of phthisis have been submitted to this treatment, all of which cases, with one exception, had reached the period of softening, and bacilli had been detected in the sputa. The results obtained were, return of appetite, even in advanced cases, gain of weight and strength, fall of temperature to the normal in a week or two, disappearance of hæmoptysis, diminution of cough and of purulency

of sputa, and cessation of dyspnoea. It is claimed that the method reduces the malady to a purely local lesion, all the general symptoms disappearing, even though *râles* may persist. M. Sée related the history of seven of his cases, all of which were relieved and some actually cured. The treatment has been efficacious in fetid bronchitis.

The Physiology of Asphyxia.

That the immediate cause of death from asphyxia, says a writer in the *Lancet*, is the arrest of the pulmonary circulation appears to be proved by the following facts: (1) When the chest of an animal is opened immediately after death caused by ligature on the trachea, the right cavities of the heart are found enormously distended, while the left are comparatively empty. (2) When the heart of an animal is exposed during the progress of asphyxia the right cavities are seen to become distended, while the left cavities, which had been previously gorged, are found to be collapsed and comparatively empty. (3) In the last stage of asphyxia there is a continuous increase of pressure in the pulmonary artery, while the systemic arterial pressure is falling. (4) That the arrest of the circulation through the lungs is due to contraction of the pulmonary arterioles appears to be proved by the influence of agents which are known to paralyze the arterioles, — e.g., nitrite of amyl, atropine, and an excessive dose of curare, the effect of which is that deprivation of air is unattended by distension of the right cavities of the heart, and other evidence of obstructed pulmonary circulation, the life of the animal is prolonged for several minutes, and death ultimately results from the toxic action of venous blood upon the cardiac and nervous tissues. (5) It is an acknowledged fact that these paralyzing agents act alike upon the systemic and the pulmonary arterioles, but the successive phenomena of asphyxia are absolutely inconsistent with the idea that the distension of the right side of the heart is a result of systemic arterial obstruction acting backwards through the left cavities of the heart and the lungs.

The Effect of Strychnine on the Stomach.

The effect of nitrate of strychnine on the functional activity of the stomach has been recently made the subject of a careful research by Dr. Gamper of St. Petersburg, who employed for the purpose of his experiments four healthy young hospital assistants. He found, as stated in the *Lancet*, that strychnine increased the amount of gastric juice secreted, the general acidity, and the quantity of free acid in the secretion. It also hastened the absorption from the stomach, and strengthened the mechanical movements. Its effect, too, continued for some time after its administration had been stopped. Like many other Russian observers, Dr. Gamper seems to have been highly impressed by the value of strychnine in chronic alcoholism, declaring that it is the most effective of all drugs in such cases. The thesis contains a long list of references to the literature of the stomach affections published in six or seven languages during the last ten years.

NOTES AND NEWS.

THE wonderful properties of nitrate of soda are just now being strikingly exhibited at the Ohio Agricultural Experiment Station, where wheat is being grown continuously under different methods of fertilizing. Although the nitrate was not applied until the middle of April, yet it has stimulated such a tremendous growth that the plots which have received nitrate in large quantity carry nearly twice as great a weight of vegetation as can be found on those which have had no nitrate.

— Four trials were conducted at the Wisconsin Agricultural Experiment Station during the fall and winter of 1890-91, under the direction of W. A. Henry, for the purpose of ascertaining the value of sweet whey for pig feeding. The results of the trials show: (1) That pigs can not be successfully maintained on whey alone. (2) Pigs fed on corn-meal and shorts with water required 552 pounds of the mixture for 100 pounds of gain. (3) When whey was added to the corn-meal and shorts mixture, it produced a marked saving in the amount of grain required for good gains. This was true for mixtures varying from two pounds of whey to one of grain, up to ten pounds of whey to one of grain. (4) It was found when using whey as a partial substitute for grain, that 760 pounds of whey effected a saving of 100 pounds of the corn-meal and shorts mixture. (5) Using these figures, if corn meal and shorts are valued at twelve dollars per ton, then whey is worth eight cents per hundred pounds; at fifteen dollars per ton for the corn-meal and shorts, whey would be worth ten cents per hundred pounds. (6) Shorts, pea-meal, and oil-meal, or like feeds, should be mixed with whey for growing animals. Some corn may be fed at all times, the proportion increasing as the animal approaches maturity.

— On Feb. 15 there occurred at Glasgow, Scotland, says *Fire and Water*, one of the most remarkable explosions of gas upon record. The illuminating-gas plant of Glasgow is the property of the municipality, and comprises three different stations. The one in question, known as Dawsholm, is situated in a somewhat isolated position outside the town, and includes three gas-holders arranged in line, about twenty-five feet apart, but fortunately as it turns out, at some little distance from the rest of the buildings and plant. The three gas-holders are all similar in respect to diameter, being 160 feet across. Two of these have lately been enlarged by the addition of a third lift, which made them 90 feet in height, and equal to containing more than 1,500,000 cubic feet of gas each. The third remained a double lift, consequently about 60 feet high, and holding something over 1,000,000 cubic feet of gas when full. At about 4.30 in the afternoon the outlet valve of No. 1 was open for the supply of the district, No. 2 shut off, and the inlet of No. 3 was open to receive the make of gas. The valve man opened the inlet of No. 2, with a view, apparently, of diverting the make from No. 3. At this time No. 1 was three parts or more full, No. 2 a little less, but sufficient to cup the lower lift, and No. 3 was not far from being full. Before the man could complete his purpose by closing No. 3 inlet, a large mass of flame was observed shooting high into the air, over the roof of No. 2, the centre holder. It was accompanied by a loud rumbling noise like the shock of an earthquake, together with a concussion that caused windows to rattle violently, and greatly alarmed the inhabitants of the neighboring part of the town. This appears to have been caused by the bursting of the roof of the gas-holder in all parts. It was quickly followed by the destruction, with a second concussion, of No. 1 holder, and in a few minutes the whole structure of both holders lay in a confused mass at the bottom of the tanks. Fortunately this was unattended with loss of life or serious injury. Workmen who happened to be in the vicinity were scorched, and some haystacks one hundred yards off were set on fire; but the enormous volume of some 3,000,000 cubic feet of gas appears to have passed steadily up into the air, and burnt away as fast as it could meet with sufficient oxygen to support combustion. The whole affair was over in four or five minutes. The experts report that they are satisfied that the holders did not contain any explosive mixture, nor did they possess structural defects. But there were "indications of an explosive material having been placed on the crown of No. 2." The explosive power, striking inward, ruptured No. 2, and the concussion was considered sufficient to account for the damage to No. 1. The "indications" appear to be an irregular fracture, having the edges bent inward, and corroded as if by the action of chemicals.

— On Feb. 6 a discovery was made in the necropolis of Thebes which the *Academy* considers second only in importance to the discovery of the royal mummies at Dehr-el-Bahari by M. Maspero, in 1881. About half a mile from Dehr-el-Bahari a pit has been found containing several hundred magnificent mummies. These, like the royal mummies, had evidently been removed from the tombs and concealed in this receptacle, as a precaution, by the servants of the priests, probably at the same time and for the same reasons which caused the royal mummies to be placed in the receptacle where they were found by M. Maspero. This removal is believed by M. Maspero to have taken place in the reign of Aauputh, son of Shasang, of the Twenty-second Dynasty. The coffins hitherto found all belong to the Twenty-first Dynasty, and are those of the priests Ra Amun and their families. The pit is

about forty-five feet in depth, at the bottom of which are two corridors filled with coffins and treasures of every description. In the lower corridor — which as yet has only been explored — it is computed that there are some two hundred coffins, and the second corridor is believed to be not less extensive. The shaft is forty-five feet deep, its mouth is about twelve feet in diameter, and its sides are of rough limestone. One of M. Grébaut's native assistants, who was superintending the work of hauling up the mummy-cases, says that he had been the first actually to enter the corridor where the mummies and treasures lie. The shaft had been excavated only as deep as the mouth of the corridor; and he crept in on his hands and knees, and stood in what he describes as being like a palace of enchantment. The corridor, he said, is some ten or twelve feet high and two hundred and fifty feet long. It runs in a northerly direction from the shaft toward the Theban hill. At the end there is a short corridor branching from it at right angles, and at some height above the floor at the end is the entrance to a second very long corridor, full of treasures, which has been sealed up for the present by M. Grébaut. Groups of mummies are placed at intervals in families. The number in each group varies from two to six or seven, father, mother, and children, and around them, exquisitely arranged, are vases, models of houses, models of *dahabiehs*, cases and boxes full of *ushabtis*, statuettes, and every conceivable treasure of ancient Egypt. Without even a speck of dust upon them, this profusion of treasures had remained unlooked at by any eye for nearly three thousand years. He said that photographs had been taken of the place in its undisturbed state, which he declared to be that of a perfectly-kept and well-arranged museum.

— The ceremony attending the burial of Prince Chun, the late prime minister of China, and father of the emperor, is said, by *The Missionary Herald*, to have been one of the grandest sights ever witnessed in Peking. No burial takes place in China till the astrologers and geomancers have fixed upon a lucky day and a lucky place for the event. On this occasion the astrologers fixed upon four o'clock in the morning as the auspicious time. As the procession started the emperor knelt in front of the coffin and bowed his head three times, each time crying aloud. Others went through the same ceremony, and then the coffin was taken up by eighty bearers. These bearers were clad in blue silk costumes. The pall was a splendid piece of crimson silk covered with gilt embroidery. Then came eight handsomely caparisoned camels and twelve milk-white horses, and men in gorgeous dresses; then four men leading small white dogs; then great crowds of men carrying flags. The umbrellas borne were a special feature. Then came a man bearing a crooked-handled umbrella, which is only carried by the emperor. Then followed images of lions, deer, and storks, all wrought in evergreen shrubs. It was a magnificant sight for Peking. But this is not the end of the funeral; the body will remain in the temple for a long time, and then will be carried with much ceremony to the imperial cemetery.

— Bulletin No. 79 of the New Jersey Agricultural Experiment Station reports an experiment in the use of nitrate of soda as a fertilizer of tomatoes, being a repetition of a similar experiment made in 1889. The experiment was made on plots of one-twentieth of an acre. The land was a sandy loam, level, well drained and in a good state of cultivation. It had been used for more than ten years in growing market garden crops, and had been uniformly cropped and fertilized for the three preceding years. The nitrate was applied, either altogether at the time of setting out the plants, or half at that time and half five weeks later, being spread broadcast. (It should never be used in the hill, as it is liable to kill the plants when used in this manner.) It was used at the rate of 160 and 320 pounds per acre, either alone or in connection with superphosphate and potash. The result was a very marked increase of crop in every case in which the nitrate was used, the most profitable increase coming from the use of nitrate alone, which paid a handsome profit in every case in which it was thus used. The experiments of the two years agree in showing that nitrate of soda, while increasing the yield, did not do so at the expense of maturity when a small quantity was used, or when a large quantity was used in two applications; but that the yield was increased at the expense of maturity when a large quantity was used in one application. Experiments made at the Ohio Experiment Station leave room for doubt whether, on a strong clay loam, tomatoes would respond so profitably to nitrate of soda as they did in New Jersey; but the trial is so easily made that tomato growers are recommended to experiment for themselves. Any dealer in commercial fertilizers should be able to supply the nitrate.

— At the seventh annual meeting of the Kansas University Science Club, May 29, 1890, papers were read as follows: "On the Chemical Analysis of a Meteorite from Tonganoxie, Kansas," by E. H. S. Bailey; "A Natural Alum from Texas," by E. E. Slosson; "Notes on Periodicity in Rainfall," "Probable Temperature of the Summer in Lawrence," and "Maximum Movements in Beams," by E. C. Murphy; "Notes on some Tertiary Conifers," and "On the Variations of Anas Obscurus," by V. L. Kellogg; "The Alkali of Kansas Soil," by E. H. S. Bailey and E. C. Case; "Fossil Diatoms," by Gertrude Crotty; "Douglas County Araneinæ" (notes, observations, and a partial list), by F. H. Kellogg; "Notes on Kansas Acrididæ," and "Some Undescribed Mallaphoga," by F. C. Schraeder; "A Preliminary List of Kansas Odonata," by Hattie Fellows; "Specific Inductivity of Certain Alloys," by Louis Russell; "Analysis of Solanum Rostratum," by L. E. Sayre and W. S. Amos; "Telephonic Apparatus for Experimental Purposes," by L. I. Blake and E. W. Caldwell; "Heterœcism in Plants," by W. C. Stevens; "A New Method for Determination of Radiation at Ordinary Temperature," by A. G. Mayer; "A Short Account of the Theory of Geometric Inversion," by H. B. Newson; "Sugar-Making in Cuba," by C. S. McFarland; "Taxidermy as a Fine Art" (illustrated by the stereopticon), by L. L. Dyche.

— At the usual monthly meeting of the Royal Meteorological Society, London, on May 20, W. H. Dines read a paper on "The Vertical Circulation of the Atmosphere in relation to the Formation of Storms." After giving an outline of the circulation of the atmosphere, the author refers to two theories which have been suggested to account for the formation of storms; (1) the convection theory, which is, that the central air rises in consequence of its greater relative warmth, this warmth being produced by the latent heat set free by condensation; and (2) the theory that the storms are circular eddies produced by the general motion of the atmosphere as a whole, just as small water-eddies are formed in a flowing stream of water. The author is of opinion that the convection theory is the more probable of the two, but more information about the temperature of the upper air is greatly needed. A paper on "Brocken Spectres in a London Fog" was read by Mr. A. W. Clayden. During the dense fogs in February last, the author made a number of experiments with the view of raising his own "spectre." This he ultimately succeeded in accomplishing by placing a steady lime-light a few feet behind his head, when his shadow was projected on the fog. He then made some careful measurements of the size and distance of the spectre, and also succeeded in taking some photographs of the phenomenon. Dr. H. Coupland Taylor read a paper on "An Account of the 'Leste,' or Hot Wind of Madeira." The "Leste" is a very dry and parching wind, sometimes very hot, blowing over the island from the east-north-east or east-south-east, and corresponds to the sirocco of Algeria, or the hot north winds from the deserts of the interior experienced in southern Australia. During its prevalence a thin haze extends over the land, and gradually thickens out at sea until the horizon is completely hidden. It is most frequent during the months of July, August, and September, and usually lasts for about three days. Shelford Bidwell exhibited an experiment showing the effect of an electrical discharge upon the condensation of steam. The shadow of a small jet of steam cast upon a white wall is, under ordinary conditions, of feeble intensity and of a neutral tint. But if the steam is electrified, the density of the shadow is at once greatly increased, and it assumes a peculiar orange brown hue. The electrical discharge appears to promote coalescence of the exceedingly minute particles of water contained in the jet, thus forming drops large enough to obstruct the more refrangible rays of light. It is suggested that this experiment

may help to explain the intense darkness, often tempered by a livid yellow glow, which is characteristic of thunder-clouds.

— The May 21 number of *Nature* states that the Göttingen Society of Sciences has recently offered the following prize in physics for Sept. 30, 1893: From the researches of W. Köntgen and A. Kundt on variation of the optical properties of quartz in the electric field, there appears to be a close connection between the electro-optic phenomena and the elastic deformations which that piëzo-electric substance shows under the action of electrostatic forces. An extension of the inquiries to a series of piëzo-electric crystals with various properties of symmetry seems highly desirable. The investigation should also be directed to determining whether the electro-optic phenomena in piëzo-electric crystals are caused exclusively by the deformations occurring in the electric field or, besides, by a direct action of the electrostatic forces on the light-motion. Prize, £25. The German Society for the Encouragement of Industry offers the following (among other) prizes: (1) How far is the chemical composition of steel, and especially the amount of carbon present, a measure of the usefulness of cutting-tools? Prize, a silver medal and £300; date, Nov. 15, 1891. (2) A silver medal and £150 for the best chemical and physical investigation of the most common iron paints. Date, Nov. 15, 1894. (3) A gold medal and £150 for the best work on the magnetism of iron. This should comprise a critical comparison of previous observations; also personal observations on steel and wrought iron bars of the most various chemical composition possible, examination being made both of the strength of temporary magnetization with absolutely measured and varying magnetizing force, and the strength of permanent magnetism and its durability with regard to temperature-changes and vibrations. Date, Nov. 15, 1893. (4) Investigation of the trustworthiness of the usual methods of determining the carbon in iron. Prize, a silver medal and £150; date, Nov. 15, 1892.

— At the Montreal meeting of the Royal Society of Canada, on May 27, papers were read as follows. In the section on English Literature, History, and Archæology, "Opportunities for the Study of Folk-Lore in Canada," by John Reade; "The Bethucks or Red Indians of Newfoundland," by Dr. Patterson; "Notes and Observations on the Shuswap People of British Columbia," by Dr. George M. Dawson; "Grammar of the Haida Language, Queen Charlotte Islands," by Charles Harrison (communicated by Dr. George Dawson); "Descriptive Notes on Certain Implements, Weapons, etc., from Graham Island," by Alex. MacKenzie (communicated by Dr. G. M. Dawson). In the section on Mathematical, Physical, and Chemical Sciences, the following papers were read: "De la Certitude dans les Sciences d'observation" (presidential address), by Monsignor T. E. Hamel; "Automatic and Multiplex Telegraphy," by F. N. Gisborne; "The Use of a Symbolic Form of de Moivres Function," by Professor N. F. Dupuis; "An Attempt at Deducing the Pressure Under which a Steam Boiler Explodes from the Dynamic Effects Produced by the Explosion" and "A Steam Boiler Explosion at Sillery, near Quebec," by C. Baillargé; "Establissement des Formules de Wrouski relatives a le Mécanique celeste," by Dr. A. Duval; "The Variation with Temperature and Concentration, of the Absorption Spectra of Aqueous Solutions of Salts," "The Density of Weak Aqueous Solutions of Nickel Sulphate," and "The Relativity of Force and the Third Law of Motion," by Professor J. G. MacGregor; "The Synthesis of a New Di-Quinoline," by Dr. R. F. Ruttan (communicated by Dr. Girdwood); "Faraday's 'Lines of Force:' Suggestion of a Name," and "Newton's Use of the Slit in the Formation of the Spectrum," by Alexander Johnson; "A New Oxy-Ether Lamp," by G. R. Prowse (communicated by Dr. Johnson); "Memoranda as to Preparations for the Proposed Telegraphic Longitude Determination: Greenwich-Montreal," by Professor McLeod (communicated by Dr. Johnson); "Observations of Sun Spots; May, 1890, to May, 1891," by Professor McLeod (communicated by Dr. Johnson); "The Time-Unit" and "The Hour Meridians," by Dr. Sanford Fleming; and "Moral and Personal Elements in Statistics," by George Hague (communicated by Sir William Dawson). In the section on Geological and Biological Sciences papers were read as follows: "The Probable Occurrence of Gold-bearing Rocks in New Brunswick," by Professor L. W. Bailey; "Notes on the Pleistocene Plants of Canada, with Descriptions of New Species from the United States," by Professor D. P. Penhallow; "The Geological Formation of Quebec, South of the River St. Lawrence," by R. W. Ells (communicated by J. F. Whiteaves); "The Present State of Botany in the Dominion of Canada, with Suggestions as to Promising Lines of Investigation, and a Proposal for United Effort in Systematic Observation throughout the Several Provinces and Territories," by George Lawson; "Note on Carboniferous Batrachians, by Sir William Dawson; "Parka decipiens. — Notes on Specimens from the Collections of James Reid," by Sir William Dawson and D. P. Penhallow; "Hibernation: a Preliminary Communication," by Professor Wesley Mills; "The Orthoceratidæ of the Cambro-Silurian Rocks of Manitoba" and "The Ammonites of the Cretaceous Rocks of the Valleys of the Peace and Athabasca Rivers," by J. F. Whiteaves; "The Geology of the St. Clair Tunnel," by Frank D. Adams (communicated by Sir William Dawson); "Observations on the Distribution and Habits of Some New Brunswick Fishes, including New Forms Lately Identified," by Philip Cox (communicated by Professor Bailey); "Illustrations of the Fauna of St. John Group, No. 6," by G. F. Matthew; "Three Deep Wells in Manitoba," by J. B. Tyrrell (communicated by Dr. G. M. Dawson); and "The Sequence of Strata forming the Quebec Group of Logan and Billings, with Remarks on the Fossil Remains Found Therein," by Henry M. Ami (communicated by Dr. G. M. Dawson).

— The *Perak Government Gazette* states that a portion of an ethnographical collection formed by Signor G. B. Cerruti, in the island of Nias, has been recently acquired by the Government of Perak for the museum. Pulo Nias, as described in *Nature*, is one of a chain of islands bordering the south-western coast of Sumatra. The population is said to be numerous and of one race, though divided into many tribes under independent chiefs. Head-hunting is as common with them as it used to be in Borneo, and most of the houses have skulls hung up in them. Their weapons consist of iron-headed spears, mostly barbed, knives of two patterns, somewhat resembling the Kadubong Achi, with shields of two distinct types. No bows and arrows or blow-pipes seem to be known, nor are throwing-sticks applied to their spears; boats also are not used by them, though rafts are sometimes made to cross rivers on. The ironwork of their weapons is fashioned by themselves, and the upright double cylinder bellows is used to supply wind to their forges — the same in every respect as those used by the Semangs of Upper Parak, and the far-away Malagasy. Helmets of black *ijoh* fibre are worn, somewhat similar to the cocoanut-fibre ones of the Sandwich Islanders. Woven body armor is in use, in the shape of thick coats made of what appears to be the fibre of *Hibiscus tiliacens*. Buffalo hide armor is also said to be used, but is not represented in this collection. Attached to the sheaths of some of the knives are four or five animals' teeth, such as tigers, rhinoceros, etc., also a small carved wooden idol, and one or more bamboo boxes containing stones. In those examined there were twelve pebbles in each box. These stones are supposed to have been taken from a spot on which a man had been slain. All these charms are tied up into a bundle with red cloth, and bound with string on the upper front part of the sheath of the knife.

— A comprehensive study of the influence of forests on the daily variation of air-temperature has been recently made by Professor Müttrich (*Nature*, May 21), the data being from stations in Germany and Austria. *Inter alia*, this influence is greater in May to September or October than in the other months. In pine and fir woods it rises gradually from January to a maximum in August or September, then falls more quickly to a minimum in December; but in beech woods a minimum occurs in April, then there is a quick rise, till the maximum is reached in July. The daily variation itself is greatest in May or June, both in forest and open country. The influence of the forest is to lower the maxima and raise the minima, and the former influence is in most months greater than the latter; in December and January, and occasionally in neighboring months, it is less. The influence on the maxima in

summer is greatest in beech woods, less in pine, and least in fir. The absolute value of the influence in woods of a given kind of tree is affected by the degree of density of the wood, being higher the denser the wood. The character of the climate (oceanic or continental) also affects the results. From daily observations in forest and open country, every two hours in the second half of June, it appears that, soon after 5 A.M. and 8 P.M., the air-temperature in the wood was equal to that in the open; that the maximum was about 0.9° lower in the wood, and the minimum 0.6° higher; that in May to September the difference sometimes reached 2.7°; that the maximum in the wood occurred about half an hour later, and the minimum a quarter of an hour earlier, than in the open; and that the daily mean air-temperature was about one-third of a degree less in the wood.

— Dr. F. M. Chisolm states, in the *American Journal of Ophthalmology*, that two curious cases, one an adult, and the other a child of ten years, presented the following physiological freak. When first noticed by the patient, it was supposed to be dirt; and when examined it presented a dark bluish line, about half an inch in length, running vertically up from the ciliary border. Under a magnifying glass it was recognized as the shaft of a hair that, in process of growth, had its tip caught as it was emerging from its follicle in the epithelium, and growth had pushed it onwards, wedging aside the epithelium, until it had gained its usual limit of size.

— The extraordinary collection of mummies, papyri, and other objects of antiquarian interest recovered last February at Dehr-el-Bahari, is now safely housed in the Ghizeh Museum. According to the Cairo correspondent of the London *Times*, all the objects are in good condition, although some anxiety was caused by the protracted journey by boats from Luxor. The correspondent says that the mummies mostly belong to the 21st Dynasty, and, though styled Priests of Ammon, are supposed to be the corpses of generals and other official dignitaries who bore ecclesiastical besides other titles. The 163 mummies and the 75 papyri are not yet unrolled, and it is difficult to form an estimate of their archæological value, as many of the sarcophagi bear different names on the outer and inner casings, whilst others have the names usually inscribed on the outer casings intentionally effaced. M. Grébaut thinks that, owing to this circumstance and the magnitude of the collection, some time will be required before any important communications can be made to the scientific world.

— A series of experiments has been lately made by Herr Rubner with regard to the familiar fact that not only dry high temperatures are more easily borne than moist, but dry cold causes much less discomfort than moist cold. Dogs, fasting or fed, being observed in an air calorimeter, it appeared that, in all cases, moist air increased the loss of heat by conduction and radiation. For every variation of the air-moisture one per cent, heat was parted with to the extent of 0.32 per cent. In a previous investigation, says *Nature*, Herr Rubner demonstrated the lessened yield of water by evaporation from animals where the air-moisture is increased, involving lessened loss of heat. Here, then, are two antagonistic influences. He is disposed to regard the increased radiation and conduction in moist air as the primary action, and the diminished evaporation as secondary. The colder feeling of moist cold than dry is readily explained by the increased heat radiation. In moist heat, with the sense of oppression it brings, this factor passes rather into the background. The degree of temperature, and some other influences, of complex nature, also affect the amount of radiation.

— The Seventh International Congress of Hygiene and Demography will be held in London, Aug. 10 to 17. The meetings of the Section of Preventive Medicine will be held under the presidency of Sir Joseph Fayrer in Burlington House, Piccadilly, on Aug. 11 to 14, between 10 A.M. and 4 P.M. On Tuesday, Aug. 11, after a short address by the president, a discussion will be held upon "The Mode of Preventing the Spread of Epidemic Disease from one Country to Another." The discussion will be opened by Surgeon-General J. M. Cunningham, C.S.I., of London. On Wednesday a discussion will be held upon "Diphtheria, with Special Reference to its Distribution, and to the Need for Comprehensive and Systematic Enquiry into the Causes of its Prevalence in Certain Countries or Parts of Countries, with a View to its Prevention." The discussion will be opened by Dr. Edward Seaton of London, and continued by leading representatives of France and America. On Thursday a discussion will be held upon "The Relation of Alcoholism to Public Health, and the Methods to be Adopted for its Prevention." The discussion will be opened by Sir Dyce Duckworth, LL.D., M.D., of London, and by Professor Westergaard of Copenhagen. On Friday papers on miscellaneous subjects will be read and discussed. A list of papers accepted by the section will be published later. Gentlemen who are desirous of joining the congress and taking part in any of the discussions, or of communicating papers on other subjects within the scope of the section, are requested to inform the honorary secretaries of the section before June 15. Abstracts of papers to be read in the section must be furnished to the honorary secretaries not later than June 15; and the full text of the papers before July 15. Communications respecting the section should be addressed to Dr. Isambard Owen, 40 Curzon Street, London, W.

— In a paper recently published in the *Meteorologische Zeitschrift*, of which a brief abstract appears in *Nature* of May 21, Professor Hellman of Berlin shows, from observations taken at different British, Continental, and American stations at which barographs are used, that there exists a close coincidence in the daily range of the monthly extremes and in that of the hourly values of the barometer. He finds that the hours of occurrence of the highest and the lowest readings of the barometer during a month agree almost completely with the times in which the normal daily range has its maxima and minima, both curves being so similar in shape that it may be possible to judge of the general character of the daily range of the barometer from knowing only the hours at which the monthly extremes mostly occur. Hence, as the lowest readings of the barometer are accompanied by cloudy and stormy weather, during which the effect of the solar radiation upon the surface of the earth and the heating of the lower strata of the atmosphere are quite insignificant, Professor Hellmann concludes that Professor Hann and others are right in assuming that the normal daily range of the barometer is chiefly an effect of the absorption of the solar rays in the upper strata of our atmosphere. Professor Hann has applied the harmonic analysis to the numbers furnished by Professor Hellman, and, by combining several stations in a group, has found the coefficients of the periodic formula to be practically the same as those for the normal daily range. We should, however, like to see a further confirmation with respect to the coincidence of the lowest readings and the diurnal minima, since the lowest readings occur so frequently during the passage of a severe storm, which can scarcely be said to have any agreement with the ordinary diurnal fluctuation.

— The first paper in the last volume of "Transactions of the Seismological Society of Japan," says *Nature*, is by Mr. Bertin, and describes the double oscillograph and its employment for the study of rolling and pitching. It traces curves automatically, showing the motion produced in a floating body by waves. The second paper is on the "Seiches" of lakes, by Dr. F. A. Forel of Geneva, and discusses those variations in the level of the water of lakes with the investigation of which the author's name has been associated for some years past. Professor John Milne describes the remarkable instrument invented by him for measuring and recording the oscillatory movements of railway trains. Mr. Mason contributes a paper, accompanied by carefully compiled tables, demonstrating the importance of elaborating some uniform system of time-keeping for the purposes of seismological observations. Professor C. G. Knott, in his paper on earthquake frequency, explodes two of the time-honored delusions of the popular mind in regard to earthquakes, viz., that they are more frequent during the night than the day, and that their periodicity is connected with lunar culminations. Mr. Otsuka gives an interesting account of the great earthquake that visited Kumamoto in July, 1888; and Mr. Pereira contributes a carefully compiled record of all the earthquakes noted by him in Yokohama from March, 1885, to December, 1889. Mr. W. E. Forster writes on earthquakes of

non-volcanic origin, caused, it is suggested, by the displacement of masses of land beneath the ocean. The volume concludes with various reports and papers by Professor Milne, such as diagrams of earthquakes recorded in Tokio, a report on earthquake observations made in Japan during the year 1889; and an essay on the connection between earthquakes and electric and magnetic phenomena, which is full of matter of an interesting and suggestive kind.

— Elementary organic analyses are commonly effected in laboratories by what are known as combustion processes. The substance to be analyzed is placed in a long glass tube and heated in proximity to copper oxide, etc., and the products of combustion are then examined. Electricity has been applied to the analysis of gases in the eudiometer, and also in many cases of what are called electrolytic separations. We are not aware, however, says the London *Electrical Review*, that it has been applied to the analysis of organic substances until quite recently. J. Oser has just worked out an entirely new method, which may be described as electro-thermal. The new method partakes of the nature of the old combustion process, of which it is really, perhaps, a modification. The substance to be burnt is placed in a small porcelain dish which is surrounded by a coil of thin platinum wire, and is contained in an ordinary hard combustion tube. A stream of pure oxygen gas is allowed to flow steadily along the tube, and at the same time the platinum wire is heated to redness by means of an electric current, the wires being kept insulated by passing through narrow apertures in a porcelain cylinder fitting into the tube. In order to insure perfect combustion, all the products of combustion, together with the excess of oxygen, are led through a narrow aperture in the porcelain cylinder filled with granular copper oxide and heated to a high temperature by an electrically ignited platinum wire which also passes through this aperture. A number of precautions appear to be necessary in order to insure satisfactory results by this method, and these, together with a table of numerical results which Oser has obtained, are given in the original paper. Oser is engaged in attempting to develop his method so that in one apparatus may be determined both the elementary analysis and the heat of combustion of any given organic substance.

— As it is desirable that uniform usage in regard to geographic nomenclature and orthography should obtain throughout the executive departments of the Government, and particularly upon the maps and charts issued by the various departments and bureaus, the following persons, who have heretofore co-operated for a similar purpose under the authority of the several departments, bureaus, and institutions with which they are connected, have been appointed by the President as a Board on Geographic Names. Professor Thomas C. Mendenhall, United States Coast and Geodetic Survey, chairman; Andrew H. Allen, Department of State; Capt. Henry L. Howison, Light-House Board, Treasury Department; Capt. Thomas Turtle, Engineer Corps, War Department; Lieut. Richardson Clover, Hydrographic Office, Navy Department; Pierson H. Bristow, Post Office Department; Otis T. Mason, Smithsonian Institution; Herbert G. Ogden, United States Coast and Geodetic Survey; Henry Gannett, United States Geological Survey; and Marcus Baker, United States Geological Survey. This board has just issued a bulletin in which it lays down the following principles, adopted for guidance in determining the official form or rendering of geographic names (*A.*—Within the United States): (1) That spelling and pronunciation which is sanctioned by local usage should in general be adopted; (2) Where names have been changed or corrupted, and such changes or corruptions have become established by local usage, it is not in general advisable to attempt to restore the original form; (3) In cases where what was evidently originally the same word appears with various spellings, sanctioned by local usage, when applied to different features, these various spellings should be regarded as in effect different names, and, as a rule, it is inadvisable to attempt to produce uniformity; (4) Where a choice is offered between two or more names for the same place or locality, all sanctioned by local usage, that which is most appropriate and euphonius should be adopted; (5) The possessive form should be avoided whenever it can be done without destroying the euphony of the name or changing its descriptive application. (*B.*—In foreign countries): (6) Geographic names in countries that use the Roman characters should be rendered in the form adopted by the country having jurisdiction, except when there are English equivalents already fixed by usage. In cases where the English equivalent is so different from the national form that the identity of the latter with the former might not be recognized, both forms may be given; (7) The spelling of geographic names that require transliteration into Roman characters should represent the principal sounds of the word as pronounced in the native tongue, in accordance with the sounds of the letters in a system published by the board. An approximation only to the true sound is aimed at in this system. The vowels are to be pronounced as in Italian and on the continent of Europe generally, and the consonants as in English.

— Platinum and palladium crystals may be made by placing topaz dust on a ribbon of the metal heated to a white heat by an electric current, the crystals appearing on the topaz.

— According to the *Colonies and India*, Mr. Alexander McPhee, a West Australian bushman, who has steadily been earning fame lately by his explorations in the central regions of Australia, started inland from Roebourne in July last on another tour of discovery, taking back at the same time an albino aboriginal whom he found and brought to Melbourne a couple of years since. News has been received from which it appears that Mr. McPhee, with the albino, Jun Gun, and a "black fellow" named Timothy, went along the coast some 250 miles to a station called Yinadong, when the party turned inland in an easterly direction. After travelling about 350 miles, Mr. McPhee came upon another albino, a boy of fourteen years, whom he describes as the most extraordinary specimen of humanity he ever saw. One old man in this camp told Mr. McPhee that when he was a boy he heard of a party of whites and horses dying a long way inland. The old fellow could give no particulars about this party, but Mr. McPhee feels certain, owing to his acquaintance with the habits and customs of the blacks, and being thoroughly conversant with their dialect, that a party of white men perished about forty years ago somewhere in the interior. He heard of Warburton's party, and saw a native who told him that he guided them to water. He also heard of two parties of whites who had lately been in the desert, but turned back. From his turning point to the coast of La Grange Bay, Mr. McPhee reckons he was about 250 miles in a south-east direction from that bay. He found the natives very friendly, and on no occasion was it necessary to keep a watch. The country is described as very poor. The only birds observed during the journey were an odd crow and a few sparrows about the water. Not a track of a kangaroo or emu was seen.

— The settlement of a purely philological question (that, namely, as to the position of the French accent), by a physical method, has been recently attempted by Dr. Prigsheim of Berlin. According to *Nature*, the instrument used was König and Scott's phonautograph, into which a number of Frenchmen were required to speak, the measurement of the record being aftewards made by means of a tuning-fork curve running parallel with it. This instrument renders possible a determination of the duration, pitch, and intensity of each syllable, and Dr. Prigsheim discusses its indications. As a preliminary result he finds that two-syllable words have the vowels pronounced with equal length and strength. Noteworthy differences appear in the curve of a word according as it occurs in the middle or at the end of a sentence. In the latter case, there is added to the characteristic word curve a terminal curve with declining pitch and strength, which is nearly the same for different words, and corresponds to the sinking of the voice before a pause. The vowels and consonants show characteristic curves; and notably long wave-lengths occur with *n*, *l*, *b*, and *d*. The duration of syllables varies between 0.1 and 0.5 second; and between the syllables of a word there are often pauses of 0.03 to 0.2 second. The shortest syllable *é* in *été*, with rather slow pronunciation, consisted of 23 vibrations; yet the ear is capable of not only hearing the tone, but of detecting fine shades and differences in the mode of pronunciation. Further experiments in this direction, with an improved apparatus, are contemplated.

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Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

PLAYING CARDS FROM JAPAN.

THE history of playing cards, their introduction into Europe from the East by the gypsies or by the home-returning Crusaders, the change and development they underwent while being adapted from the cards of the Orient and altered into those that are familiar to our eyes, have been dwelt upon by numbers of writers; but the cards used in Japan have not been mentioned in any of the best known histories, although they are more distinctly original than any others, and they show no marks of the common origin which the Italian, Spanish, German, French, Hindu, and Chinese cards display.

The Japanese cards, we learn from a paper by Mrs. J. King van Rensselaer, in the "Proceedings of the National Museum" (Vol. XIII, No. 836), are oblong, and are made of pasteboard. The backs are painted black, with none of the checkered dotted marks which usually decorate European cards. The designs seem to be stencilled, and are brightly and appropriately colored, and then covered with an enamel or varnish, which makes them quite as slippery as our own. They are very much smaller than our cards, being a little more than two inches long by one broad.

Forty nine in number, they are divided into twelve suits of four cards in each suit. One card is a trifle smaller than the rest of the pack, and has a plain white face not embellished with any distinctive emblem. and this one is used as a "joker." The other cards are covered with designs that represent twelve flowers or other things appropriate to the weeks of the year. Each card is distinct and different from its fellows, even if bearing the same emblem, and they can be easily distinguished and classified, not only by the symbolic flowers they bear, but also by a character or letter that marks nearly every card, and which seems to denote the vegetable that represents the month. The only month that has no floral emblem is August, and that suit is marked by mountains and warm-looking skies.

January is represented by pine trees, which, on two of the cards, are shown against a lurid sky; the third one has a grayish background, that throws the trees into strong relief, and the fourth has a setting sun flecked with light clouds, the pines barely indicated in front of it, and the greater part of the card covered with the figure of a huge white-bodied, red-eyed stork.

February displays as its emblem a plum blossom, the four cards devoted to this month bearing its flower in various positions.

March has a red cherry blossom, and April the hanging tendrils of the wistaria vine. On one of the cards of this suit is a wee yellow-bird, which is flying across its surface under a crimson cloud.

For May there are beautiful blue iris springing from long spiky leaves. One card shows in one of its corners part of a dock or pier, and also the water, out of which the flower is lifting its lovely head.

June is represented by blood-red peonies, over one of which two yellow butterflies are hovering.

On July's cards star-shaped leaves, some yellow, some red, and some black, are scattered over their surfaces. These leaves resemble those of our gum or liquid amber trees, but they bear the Japanese name of *hāgi*. On one of the cards belonging to this suit a deer is represented standing under the branches of this strangely-hued tree. This is the only figure which recalls in any way the emblems used on cards belonging to other nations, as on one of the Chinese cards is found either a deer or else Chinese characters which have been translated to mean "This is a deer."

August is represented by four pictures of grass-covered mountains, in three of which they are sharply defined against a clouded blue sky, and in the fourth the sun, looking hot and sultry, beams down on a treeless hill. Three birds fly across the sky on one of these cards.

September bears the Mikado's flower, a yellow and red chrysanthemum; October, a maple tree with red or yellow leaves; and on one card is a yellow boar trotting off towards the symbolic tree.

November shows on one of its cards a willow sharply outlined against a leaden sky. The willows on a fellow-card look wind-tossed, and a long-tailed bird skims across the sky. A third card is covered with inky clouds, torrents of rain, and strange zigzags resembling forked lightning. The fourth card of this suit bears a quaint figure of a man rushing through the storm under the willow trees and dropping his sandals in his haste, his head covered with a huge yellow umbrella. Streaks of lightning surround the little figure, and the storm of rain is well depicted in the picture.

December bears the imperial Japanese plant *kiri*, and over one of these flowers hovers a beautiful red-crested silver-winged pheasant.

An infinite variety of games are played with these cards, as there is a shade of difference in each one of each set, and in some games each has a separate value. The favorite game in Japan at present is very like cassino, in which any card of a set may take any other, but all have their own values in the final count.

HEMP CULTIVATION IN THE PHILIPPINE ISLANDS.

THE Manila hemp plant, which is very similar to the banana or plantain, thrives best in soil composed of decayed vegetable matter, the principal districts in the Philippine Islands in which it is cultivated being reclaimed forest land. The yield, according to Mr. Gollan, British consul at Manila, is more abundant on hilly land than on low-lying flat ground, and the volcanic nature of the soil of the islands seems to be particularly adapted to the growth of the plant. The production is chiefly in the southern districts, where the rainfall is greater than in the vicinity of Manila. The trees suffer severely from excessive heat and drought. The custom in the Philippines is, after clearing the land, to plant small plants of about three feet high, leaving a space of from two to three yards between, the young shoots which spring up later around the parent stems filling up the intervening space. The ground is carefully cleaned and weeded at least twice a year.

As a rule it takes about three years to produce a full crop, but in a favorable soil a crop of about one-third the full production would be available in two years after planting. the second crop the following year would yield about two-thirds, and by the fourth year a full crop would be obtained. The trees are ready for cutting when the first shoots begin to be thrown out. When the trees have matured and are ready for cutting, they are cut down about a foot from the ground, and layers are stripped off the trunk. These layers are then cut into strips about three inches in width. The strips are then drawn between a blunt knife and a board, to remove the vegetable matter from the fibre, which latter is placed in the sun to dry. As soon as it is thoroughly dried it is ready for the market.

The appearance and consequent value of the fibre depends mainly upon the care taken in drying it, as should it be exposed to rain and not completely dried, it becomes discolored, assumes a brownish tint, and loses its strength to a considerable extent. The outside layer produces a reddish-colored fibre, which is quite sound, and easily distinguishable from spoiled hemp, but fetches a lower price in the market.

The cost of preparing and planting a *quinon* (about seven acres), and keeping it clean up to the time of the first crop, is estimated at from two to three hundred dollars, not including the first cost of the land; and afterwards an annual outlay of about sixty dollars would be required to keep the soil free from weeds, etc. The extent of land mentioned, after the plantation is three years old, would produce from sixteen to twenty bales per annum, according to the quality of the soil.

Almost without exception, landowners who devote themselves to the production of hemp in the Philippine Islands are European Spaniards, or natives of the islands, and a foreigner would have considerable difficulty in establishing himself, and would meet with many obstacles before he found himself in touch with his surroundings. Foreigners can only own land in the Philippine Islands under the following conditions, which are strictly enforced: (1) That they reside in the Philippine Islands, and are duly registered in the books of their respective consulates and of the government. (2) That their lands be sold, should they leave the islands and establish their domicile elsewhere. (3) That, in the event of the death of a landed proprietor, his heirs be compelled to reside within the territory of the Philippine Islands, or sell the property. The acquisition of land by foreign companies or associations is absolutely prohibited.

The cost of native labor is about twenty or twenty-five cents a day; but the principle upon which the hemp plantations are worked is, that the laborer gets one half of the result of his work, the other half going to the proprietor. A laborer, under pressure, can clean about twenty pounds of hemp per day; but, as a rule, the quantity cleaned by one man, working steadily day by day, averages about twelve pounds. Many unsuccessful attempts have been made to improve upon the primitive knife and board, which are, up to the present, the only means used for cleaning the fibre. The great faults of the new inventions have been the weight of the machine, and the additional liability to break the fibre. A necessary requirement for any new machine which would replace the present method is, that it should be light enough to be easily carried about by the workmen from place to place on the plantation. The exports of hemp from the Philippine Islands, in 1890, amounted to 63,270 tons, which, at the average price for the year, realized about ten and a half million dollars.

THE ELECTROLYSIS OF ANIMAL TISSUES.

THE first number of "Studies from a Physiological Laboratory, Owen's College, Manchester," contains a paper by G. N. Stewart, which is an interesting contribution to our limited knowledge of the action of electricity in relation to animal tissues. From an abstract of this paper, which we find in a recent number of the London *Electrical Review*, it seems that practically the whole of the conduction in animal tissues is electrolytic, and the electrolytes are principally the mineral salts, changes in the proteids being produced by secondary electrolytic actions.

In simple proteid solutions, conduction occurs with great difficulty if mineral salts are absent, or if they are present only in small proportions. The effects on the proteids themselves in saline solutions vary somewhat with the current density. Alkali-albumin is formed at the cathode, and acid-albumin at the anode; while in solutions of coagulable proteids there is also coagulation at the latter pole. With a strong current, the proportion of coagulated proteid to acid-albumin is greater than with a weak current. In bile and urine it was observed that the conduction is also chiefly due to electrolysis in the mineral substances, and not in the organic substances contained in these secretions. In blood, the changes which take place in the proteids are similar to those which are mentioned above. There is also a formation of acid-hæmatine (mixed with or preceded by methæmoglobine with certain strengths of current) and of alkali-hæmatine at the anode and cathode, respectively. There is no evidence that hæmoglobine or any of its derivatives can act as an ion.

In muscle the nuclei become apparent and the sarcous substance granular at the anode; this is the appearance always produced by a weak acid. At the cathode the fibres become more homogeneous. The chief chemical changes in proteids are, an increase in the neutralization precipitate of the aqueous extract, and a corresponding decrease of the globuline. At the anode the neutralization precipitate is increased, but the amount of globuline is more than correspondingly diminished, because part of this proteid is coagulated. The effects of electrolysis on the salts of the muscles were studied by estimating the ash. Striking changes were found to occur, which, if produced within the living body, would profoundly modify nutrition. The antiseptic action of the current was studied in the case of micro-organisms, and it was found to occur chiefly, if not entirely, around the anode.

In another and later paper specially devoted to the electrolysis and putrefaction of bile, Mr Stewart shows that when bile is electrolyzed in a U tube, changes take place at the negative pole, which are similar to those which occur when bile is allowed to putrefy; that is, the pigment changes to brown through light shades, ultimately becoming yellow. In the early stages of the electrolysis a reversal of the current restores the original color. The anode has an oxidizing, the cathode a reducing, action upon bile. The bile salts are electrolytes, and an acid constituent of these crystallizes at the anode in long needles; but the conductivity of bile salts is small as compared with that of the inorganic constituents of the secretion.

With these results for bile we may compare those obtained by J. B. Haycraft and H. Scofield (Zeit. Physiol. Chem., xiv., 193). In the course of their researches they showed that a play of colors is obtained at the positive pole of a battery (four Grove cells) placed in the bile, indicating successive stages of oxidization: if the negative pole be then placed in the bile, the effects are reversed, indicating reduction.

Mr. Stewart makes some attempt to connect this knowledge of the electrolysis of animal tissues with the application of electrolysis in surgery, and promises a further communication on the physiological aspects of the question.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Osteological Notes.

IN my notes published in *Science*, Vol XVI., p. 332, upon the significance of the jugal arch, I stated that although this arch is often composed of three bones, this number was sometimes reduced to two, and in some cases rendered still more rudimentary, but that in no case could the arch be said to be absolutely wanting. Moreover, that the number of bones present, as well as the strength of the arch, depended upon the extent of surface, and upon the amount and form of curvature, and these, in turn, upon the advanced or receded position of the orbit, as also upon that of the articulation of the mandible, whether above, below, or upon a level with the orbital cavity. These also are correlated with the extent of surface presented by the ascending process of the lower jaw with the adjoining crests, processes, fossæ, with the dental series, and necessarily with the muscles of mastication.

I cited the *Carnivora* as presenting the most instructive example of the various points to be considered in connection with the morphology of the arch, every one of these having reference to enormous development and implying great strength and capacity.

I also cited certain of the *Edentata* as exhibiting the exactly opposite condition, — a rudimentary and incomplete arch, with consequent feeble muscular power, no necessity for mastication, and an entire absence of teeth.

In the crania of the *Primates*, the jugal arch is composed of two bones, the zygomatic process of the squamosal, and the malar; which last, resting upon and articulating with the maxilla, is joined with the squamosal process by a serrated suture which inclines downwards and backwards, the amount of the inclination being modified in the various groups of this order. The strength and curvature of the arch also widely vary, as also does the extent to which the various crests and ridges for muscular attachment are developed. In man, the arch is generally slender, slightly curved in its horizontal axis, and presents a very moderate convexity upwards in its vertical curvature. Owing to the very slight horizontal curvature outwards, the temporal fossa is relatively shallow, consequently allowing but little development of the temporal muscle This condition, however, is subject to modifications in the various races of man. The maximum breadth of the cranium is at the jugal arches, and it is at these points that craniologists now take the bi zygomatic diameter of the face.

Humphrey, in his "Human Skeleton," in speaking of this arch, says: "The upper surface of its root forms a smooth channel for play of the temporal muscle. In the negro the greater width of this channel throws out the zygoma into stronger relief, and, added to the flatness of the squamosal portion, affords more space for the temporal muscle." In other words, the negro has a more fully developed temporal muscle than the white man; that is, he approaches nearer to the *Carnivora*. This general statement is not confirmed by any cranial measurements, neither does Mr. Humphrey state what he means by a negro — of course, one of the black race. But under the term "black race" are included the Oceanic negroes, as well as the natives of central and southern Africa Probably he intended, as in common parlance, to designate the African, although this designation is ambiguous, as it is well known that the crania of the different tribes of Africa differ very essentially in their general formation, as well as in their special cranial measurements.

Although the cephalic measurements of Broca, Topinard, and others allow a slight increase in the horizontal curvature of the arch in certain instances, which, if they indicate anything, signify a greater development of the temporal muscle, as well as a more extended surface for the attachment of the masseter, both of which, as we have seen, highly characterize the arch in the *Carnivora*; yet, as Topinard remarks, in speaking of the bi-zygomatic diameter, which may be accepted as the criterion of the greatest facial width: "This measurement by itself often presents difficulties, purely accidental and local, and entirely apart from the general type. Thus, in every race, cases occur in which the zygomatic process of the squamosal, instead of joining directly with the molar, bends outwards and then resumes the general characteristic direction of the arch, whether this be straight or gently curved. The greatest width under these circumstances falls upon the summit of the bend, which causes the measurement to be unduly augmented."

As a result of the measurements taken upon the crania of the Africans in the collection of the Peabody Museum, and of the Harvard Medical School, there was a slight increase in the bi-zygomatic breadth over those of other mixed European skulls. But no dependence should be put in such measurements, for although in one collection the crania were classified in general as African, nothing was known of their history, and still less of those with which they were compared.

According to an extract from M. Pruner-Bey's tables, as given by Topinard, the bi-zygomatic breadth, compared with the total length of the face, is greater in the Esquimo, Chinese, Scandinavians, Germans (south), and New Caledonians than it is in the negroes of Africa. In the category of crania in the British Museum Mr. Flower gives the index of breadth of the African negroes of various tribes. The low conformation of those, in this respect, is only exceeded by the Eskimo, Australians, Melanesians, Kaffirs, and Zulus.

In order to substantiate the statement made by Mr. Humphrey it would seem to be much the most scientific method to ascertain by measurement the actual width of the groove in the upper surface of the posterior root of the zygoma of the African skull, and compare this with that of other races. This can be properly effected by taking first the bi zygomatic breadth, and then the bi-squamosal at the most prominent point on the line of suture between the squamosal and alisphenoid, the difference between the two measurements would give the breadth of groove.

Cuvier reminds us that the size of the temporal fossa and its muscle have close relation with the age of the animal. In the young, the brain and its case are developed, but the jaws are small, and the forces which move them are wanting in energy. But with age these last are developed, while the intellectual powers constantly diminish. In civilized man the equilibrium is maintained between the growth of the brain-case, the intellectual powers, and the masticatory organs. Can any relation, however remote, be traced between the developed masticatory powers of the uncivilized negro, and the flattened squamosal in his brain-case as described by Mr. Humphrey? D. D. SLADE.

Cambridge, Mass., May 27.

Anatomy of the Apteryx.

By far one of the most important anatomical papers which has appeared since the present year commenced is a memoir by Professor T. Jeffrey Parker, F.R.S., of the University of Otago, New Zealand, entitled "Observations on the Anatomy and Development of Apteryx." This remarkable bird-form, now becoming quite rare, is so well known to biologists that the several species of the genus will require no special description from me here. Nor will the vast importance to anatomical science of a complete study of its structure and embryology stand in need of comment. What Mr. Parker has accomplished in that direction is now before me, — one of the classical publications of the Royal Society of London, brought out through its Philophical Transactions, it being the work to which I desire to invite attention.

This monograph is in the usual quarto form, and covers 134 pages, and is illustrated by sixteen lithographic plates, beautifully executed in color. These last are devoted to the external characters of the embryo; to sections of the same; to graphic representations of the rate of growth; to the morphology of the skull and skeleton of the young at various stages; and to certain parts of the anatomy of the adult. They include 310 figures. *Apteryx bulleri*, *A. australis*, and *A. oweni* are followed, more or less completely, through fourteen various stages of their growth, the whole resulting in a very full embryological chapter. Among the more important points arrived at by our author are, (1) in the adult *Apteryx*, as well as in advanced embryos, the pterylosis is by no means uninterrupted, as was originally supposed to be the case by Nitsch; (2) that the lateral apterial space has a definite function in connection with the attitude assumed by the bird during sleep; (3) that the study of the structure of the wing of *Apteryx* lends support to the view that the *Ratitæ* are the descendants of birds which possessed the power of flight; (4) the demonstration of the law of growth of *Apteryx*, giving the stages in which the head, beak, brain, sternum, and limbs arrive at their maximum dimensions, and the comparative and relative rates of the growth; (5) the specific and sexual differences; (6) the discovery of nine more muscles in the wing of the adult than were known to Owen, our former authority on the subject; and (7) the presence of the pecten in the eye during embryonic life.

In conclusion the phylogeny is given, and under that caption are arrayed the characters which go to support the view that *Apteryx* is derived from a typical avian form capable of flight. Fifteen characters are well chosen for that purpose, — the only opposed one suggested being the total absence of rectrices in *Apteryx*. This *résumé* is followed by a summary of other sets of characters supporting (1) the derivation from a more generalized type than existing birds, and the converse, (2) as exhibiting greater specialization than other birds. Fifty-five works are given in a list at the close of the monograph, as having been referred to during its production. Only one American authority is mentioned, and we must believe that the important labors of Morse on "The Carpus and Tarsus of Birds" would have been found useful, to say not a word of a number of others.

It remains for me but to say that this admirable paper of Professor Parker's will surely make its influence felt at once, and will

receive a hearty welcome from anatomists in all quarters of the globe, as a most thorough and capable contribution to the subject of vertebrate morphology. R. W. SHUFELDT.

Takoma, D.C., May 29.

BOOK-REVIEWS.

The Defences of Norumbega. By EBEN NORTON HORSFORD. Boston and New York, Houghton, Mifflin, & Co., 1891.

IN this sumptuously published volume, with its numerous reproductions of old maps, its photographic views and engravings, Professor Horsford returns to the arena in defence of his favorite theory that in the eleventh century the Northmen established an important walled city on the site where Watertown, Mass., now stands. He believes that he has discovered its stone-built walls, its ancient stone-paved streets, and the remains of its docks and wharves. Other local antiquaries see in these remains merely the vestiges of some dams, drains, and stone fences of the early New England farmers, and it appears that Professor Horsford has not succeeded in persuading any of the resident investigators of the interpretation he has so much at heart. Furthermore, the most recent and careful study of the Sagas of the Northmen's voyages to America — that by Professor Gustav Storm — declares that the records do not admit of placing the southern limit of their explorations south of Nova Scotia. We must therefore return the Scotch verdict of "not proven," on the evidence before us.

Civilization: an Historical Review of its Elements. By CHARLES MORRIS. Chicago, S. C. Grigg's & Co. 2 vols.

MR. MORRIS is known as a fertile writer on topics relating to evolution, and as the author of "The Aryan Race" and some other works. In the volumes before us he undertakes "to set forth the philosophy of human progress and indicate the evolutionary steps by which the world of man has passed upward from primitive savagery to modern enlightment."

In carrying out this plan he selects such subjects as government, war, religion, law, commerce, literature, and the arts, and portrays their growth from a primitive form to that condition in which we find them to-day. This is usually accomplished in a comprehensive and satisfactory manner; but the reader is not unfrequently at a loss, as he is repeatedly in Mr. Morris's "Aryan Race," to distinguish between fanciful hypotheses of the writer and definite results of other investigators, for his pages offer no references as guides, and his assertions usually go unsupported. As a popular work, however, it deserves commendation.

AMONG THE PUBLISHERS.

THE first number of *Pantobiblion* has just been received from the American publishers, Messrs D. Appleton & Co., New York. This new periodical has its main office in St. Petersburg, and is edited by A. Kersha, a civil engineer. The title-page of the number received is in English, but the text is printed in fifteen different languages. The purpose of *Pantobiblion* is to help those concerned with the applied sciences generally in securing information of the current scientific literature in their specialities. To do this, the journal contains a classified list of all new books in all the principal languages, a series of reviews of the leading scientific publications, and a summary of the contents of current periodical literature. It is intended to add to these, critical notices of the principal articles in scientific periodicals, and a miscellaneous department to be devoted to short notes on current scientific literature. This first number contains 1.200 titles of new publications, 80 reviews, and the "contents" of 270 periodicals. That it may not be thought that this new venture is only for those interested in applied science, it should be mentioned that the subjects included cover a wide range in the physical sciences as well as in engineering, and that botany and geology receive some attention. There has been some delay in getting out this initial number, — a delay which is by no means surprising considering the enormous labor involved in the editing and manufacture of a periodical containing such a mass of disconnected information, — but the following numbers are promised to follow in rapid succession. Whether *Pantobiblion* is to be a financial success or not is more than we can say; but certainly every one interested should take the first opportunity for examining a copy, to see whether it meets his needs. There is such an enormous amount of matter between the covers that the first impression on us is somewhat appalling.

—The University Extension movement takes so prominent a place among the educational influences of the age, says *Nature*, that a good account of the system has for some time been needed. This is supplied in "Eighteen Years of University Extension," by R. D. Roberts (Cambridge, University Press). Mr. Roberts, first as lecturer, then since 1881 as assistant and organizing secretary to the Cambridge Syndicate, and since 1886 as secretary to the London Society, has had the best possible opportunities of studying the new method, and of forming a judgment as to its fitness for the uses to which it is applied. He begins with an account of the origin and growth of the movement, then describes the character of the audiences, the reception of the idea by artisans, and the signs of earnestness displayed by various classes of students. Mr. Roberts also discusses the conditions of success, has a chapter on the consolidation of the work, and presents a summary of results. No essential fact has been omitted, and the general impression which will be left on the minds of most readers probably is that those connected with the movement have done much to foster and to satisfy the desire of a very large number of persons for intellectual training. There are certain rules—some of them rather difficult—with which the system must be brought into accord if it is to be capable of further development; and these are stated with much force and precision in the useful little volume.

— With the June number the *Educational Review* begins its second volume. At this season, when many young men are considering where they will study in Europe, the article on "The Present Condition of the German Universities," by Professor Mattoon M. Curtis, has a timely interest. Other contributions to the number are: "Applications of Psychology in Education," by Dr. Mary Putnam Jacobi, illustrated with twenty-one diagrams; "The American High School," by Ray Greene Huling, president of the American Institute of Instruction; and "The Education of the Will," by Professor J. Clark Murray; a discussion between Mr. Albert L. Arey and Professor Fernando Sanford on "The Use of Text-books in Teaching Elementary Science," and one by Superintendent W. H. Maxwell on "Teachers' Salaries." The reviews are by Professors Jastrow of the University of Wisconsin, Waggener of the University of Texas, Venable of the University of Virginia, Genung of Amherst, Chapin of Wollesley, Myers of the University of Cincinnati, etc. The department of "Education in Foreign Periodicals" includes "Some Characteristics of a Sound Mind," "The School of the Future," and "The School for Oriental Languages at Berlin."

— The "Annual Report" of the Director of the Royal Alfred Observatory, Mauritius, for the year 1889, as quoted in a recent number of *Nature*, shows that the island has again enjoyed immunity from storms. The greatest hourly velocity of the wind was 31 miles. The almost total absence of tropical cyclones in the south Indian Ocean during the year is considered by Dr. Meldrum as another confirmation of the law that these cyclones are fewest in number and least intense in the years of least solar activity. The mean temperature was 0.7° below the average for the last fifteen years, and below the average in every month except July and October. The maximum shade temperature was 93.1° on March 27, and the minimum 52.4° on June 18. The rainfall was 8.56 inches above the average; the greatest fall in one day was 3.88 inches on March 11, although this amount was much exceeded in other parts of the island. On Jan. 1, a waterspout burst on the Pouce Mountain; Port Louis was flooded, and some persons were drowned. The collection of observations made at sea is actively carried on; 324 log-books were received, and the observations duly tabulated. The report also contains observations made at the Seychelles and Rodriguez.

— Silver, Burdett, & Co., Boston, announce "An Elementary Handbook of Potable Water," by Floyd Davis, professor of chemistry in Drake University. Chapter I. of the volume treats of pure water, and defines the terms pure and impure, wholesome and unwholesome, from the sanitary standpoint. Chapter II. is devoted to inorganic constituents; Chapter III., to vegetable con-

stituents; and Chapter IV., to animal constituents. Chapter V. presents a treatise on micro-organisms, Chapters VI., VII., VIII., discuss water-supplies, natural purification, and artificial purification, and Chapter IX. describes eight different systems for central filtration. An appendix, divided into two sections, closes the book. Section A treats of the origin and home of cholera. Section B presents four simple qualitative tests for impurities in drinking-water.

— *Babyhood* for June considers the seasonable question of what to do with children in the city and country, and how to provide for their welfare generally, during the heated term; and a medical paper by Dr. Walter Mendelson, on "Practical Directions for Sterilizing Milk," offers an account of this important subject.

— Several new leaflets are to be added to the general series of "Old South Leaflets," published by D. C. Heath & Co., Boston. All of them are connected with the English Puritan period, and are of value in the study of the development of our own political liberty and of our political system. They include the "Petition of Right," presented by Parliament to King Charles in 1628; the "Grand Remonstrance;" the "Solemn League and Covenant," which gave the name of "Covenanters" to the Scottish Protestants; the "Agreement of the People;" the "Instrument of Government," under which Cromwell began his government; and "Cromwell's First Speech to his Parliament." These leaflets furnish these original documents, heretofore almost inaccessible to the mass of the people, for the few cents covering their cost. There are now nearly thirty in the series.

— Macmillan & Co. will shortly publish "Studies of the Gods in Greece at Certain Sanctuaries Recently Excavated," by Mr. Louis Dyer, formerly assistant professor in Harvard University. The book represents a course of lectures delivered by Mr. Dyer at the Lowell Institute, Boston; but the material has undergone very thorough revision, and notes and appendixes have been added on special points. The same firm are also going to publish "Browning as a Philosophical and Religious Teacher," by Professor Jones of University College. This work deals with Browning, not simply as a poet, but as the exponent of a system of ideas on moral and religious subjects, which may fairly be called a philosophy.

— In the June number of *The Political Science Quarterly* Professor Burgess of Columbia College discusses the international and constitutional questions raised by the recent controversy with Italy. He holds that a foreign government whose subjects have been wronged is entitled to demand that the United States Government should initiate proceedings against wrong-doers in the United States courts. He finds that the Constitution vests in the Federal Government the power to do this, but that Congress has not passed the necessary statutes to make this power effective. Horace White writes on bimetallism in France, showing that all attempts to keep the two metals in equipoise have proved unsuccessful. F. M. Drew gives an account of the organization and

Publications received at Editor's Office, May 27–June 2.

FRAZER, Persifor. Tables for the Determination of Minerals by Physical Properties. 3d ed. Philadelphia, Lippincott 115 p. 8°. $2.
GEORGE, Henry. Protection or Free Trade? New York, Henry George & Co. 216 p. 12°. 25 cents.
GLEN Echo Chautauqua. Vol. I. No. 1. *m.* Washington, Glen Echo Chautauqua Assoc. 20 p. 4°. 50 cents per year.
NOVA Scotia, Annual Report of the Secretary of Agriculture, for the year 1890. Halifax, Government. 310 p. 8°.
PANTOBIBLION: International Bibliographical Review of the World's Scientific Literature. Vol. I. No. 1. *m.* A. KERSHA, ed. (St. Petersburg, Paris, Leipzig, Bologna, London), New York, Appleton. 287 p. 8°.
SLOANE, T. O'C. The Arithmetic of Electricity. New York, Henly & Co. 138 p. 12°. $1.

aims of the Farmers' Alliance and kindred bodies. E. J. Renick of the Treasury Department explains and criticises the method of accounting employed by the United States Government. Gaillard Hunt of the Department of State contributes a chapter to the history of the nullification movement in South Carolina, and Professor Osgood of Columbia concludes his study of the political ideas of the Puritans. The number contains also the usual reviews of current political literature, and the semi-annual instalment of Professor Dunning's record of political events.

— Messrs. Houghton, Mifflin, & Co. have published "Noto: an Unexplored Corner of Japan," by Perceval Lowell. It is an account of a journey from Tokyo to a comparatively unknown province on the western coast, a journey, however, which proved rather unsuccessful, owing to the impassability of certain parts of the country. The book is written in an affected style, which is not to our taste, while it gives comparatively little information about the country visited. The author's personality is thrust continually into the foreground — a fault that books of travel are altogether too apt to have. Readers do not care a straw for the author's personal doings and adventures: what they want is a description of the country visited and of the people who inhabit it, and it is strange that travellers do not realize this. Mr. Lowell's book, however, does give some such information, if one has the patience to pick it out from the mass of irrelevant matter in which it is embedded.

— Photographers have long felt the need of a practical text-book on photographic optics, than which no subject connected with their work is more important for them thoroughly to understand. To meet the growing demand for such a text-book the Scovill & Adams Company, of this city, have just published "Photographic Optics," by W. K. Burton. The book is intended for the use of both professional and amateur, has good illustrations, sufficient in number for the purpose in view, and should add to the completeness of every photographer's equipment.

SCIENCE

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CALENDAR OF SOCIETIES.

Appalachian Mountain Club, Boston.

June 10.—S. F. Whiting, Through the Great Glen of Scotland to the Top of Ben Nevis; John L. Batchelder, jun., On Foot from Salzburg to Geneva.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head* FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.

A POLYTECHNIC INSTITUTE GRADUATE, with one year's experience, wants a position as Teacher of Mathematics, Physics, English, and Mechanical Drawing, or as Assistant in a Mechanical or Engineering Laboratory. For particulars address P. O. Box 755, Worcester, Mass.

WANTED—Four additional Teachers for the whole or part of the summer at the Summer School of Languages, Bryant School, Roslyn, L. I., N. Y. One of them at least should be a teacher of conchology and the botany and biology of the ocean, one a geologist, and one a native of France.

A CHEMIST, who has taken a thorough course in chemistry in one of our best institutions, would like a position as assistant in an iron firm or in any industrial establishment. Correspondence solicited. JOHN N. BARBER, Box 743, Amherst, Mass.

AN experienced tutor, Latin, English, German, Science, wishes an engagement in High School or Academy for September commencing. H. L. M., 248 West 45th Street, New York City.

A GRADUATE of Yale College, now a medical student, who has made a specialty of the sciences, wishes employment during the summer vacation, from June 15th, to Oct. 1st, GEO. N. LAWSON, 22 College St., New Haven, Conn.

WANTED.—A permanent position that will pay $15 per week with prospect of advancement, by a young man (23) and college graduate of one year's experience. Address J. S. M., care of SCIENCE, 47 Lafayette Place, New York City.

WANTED.—Vols. I and II. of Allen's "Commercial Organic Analysis." SCIENCE BOOK AGENCY, 47 Lafayette Place, New York.

THERE is an opening in this office for a college graduate with scientific tastes. *Science*, 47 Lafayette Place, New York.

WANTED—A situation in an Analytical Laboratory during the summer vacation. Can give good references. Address M. ADGATE, North College, Burlington, Vt.

WANTED—A position in some College, Normal School or Academy to teach Biology, Physiology, Comparative Anatomy, Histology, Embryology or Botany. A graduate of the University of Wisconsin. Have had four years' experience as a teacher. Address "BIOLOGIST," care SCIENCE.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

For sale, or exchange for geological works, the following works in anatomy, all latest editions: Allan, Tuain, Gray, Leidy, Massey, and Rollestin's Forms of Animal Life. S. W. Williston, Lawrence, Kan.

Will exchange a new Thomson reflecting astatic galvanometer, about 6,000 ohms, made by Clark, Muirhead & Co., London, and costing £30, with 1-9, 1-99, 1-999, shunts, lampand scale, for a Weston voltmeter and ammeter, or arge Wheatstone bridge, dial pattern, or a portable testing outfit. Address G. A., *Science* Office, 47 Lafayette Place, New York.

For exchange—Fossil leaves from the Laramie beds of South Table Mountain, near Golden, Col., for other fossils, historical relics, or minerals. Address John B. Garvin, State School of Mines, Golden, Col.

For Sale or Exchange—All forms and species of Canadian birds, mammals, insects, reptiles, fish or other natural history specimens. First class specimens only supplied. G. E. Atkinson, 639 Spadina Ave., Toronto, Can.

I would like to exchange first six vols. Roscoe and Schorleminer's Chemistry, and Vols. II. and III. of "Education" for American Naturalist for 1889 and 1890, or works on Zoölogy. C. Dwight Marsh, Ripon College, Ripon, Wis.

SCIENCE

NEW YORK, JUNE 12, 1891.

RECENT EXPERIMENTS IN AUTOMATIC WRITING.[1]

It is well to state, at the outset of this paper, that it will not be found to contain anything new or startling. Nor does it seem to me that these characteristics are necessary to its usefulness. For though such features have a value of their own in stimulating inquiry, and in forming matter for assimilation by future investigators who shall have ascertained the principles or laws which, in our present state of knowledge, we are only groping after, they at present rather confound than assist our reason. On the other hand, the more we gain in experimental acquaintance with the psychical side of existence in the living subject, the more likely of fruition, because the more easy of classification, will be those rare and sporadic phenomena which may be gleaned from the world of phantasm and of second sight.

While, therefore, facts of all kinds are valuable to us, the most hopeful method of psychical research appears to me to proceed from the known to the unknown, and from the simple to the complex, and thus, by studying the grammar of research, to find gradually the meaning of fact after fact which at present convey no more significance to us than so many undeciphered hieroglyphics.

To no person are we more indebted for showing us this path to the knowledge which we seek than to Edmund Gurney, whose experiments in hypnotism have thrown a new light upon the constitution of human personality in the living man, and my desire, in the kind of experiments I am about to record, is to follow humbly in his footsteps.

In comparing hypnotic experiment with automatic writing, we find both advantage and disadvantage. The advantages of hypnotism are, the opportunities for studying physiological as well as psychical phenomena, the absolute control which it gives us over the subject, unchecked by his self-consciousness, fear of ridicule, and the like, and the greater security from conscious reception or prejudiced ideas which it assures us of as long as hypnosis lasts. On the other hand, granting the good faith of the automatic writer, we can obtain nearly as full results on the psychical side, without risk, or the imputation of risk, to the moral or physical well-being of the operator, and can pursue the inquiry at any spare moment and with no further appliances than a pencil and a sheet of paper.

One thing, however, is essential, and that is an unprejudiced mind. In automatic writing we are confronted at once with a mysterious intelligent agency, operating without the conscious will or mental participation of the writer, but subject, as I am inclined to think, to suggestion in the highest degree. Let it be impressed upon the mind of the writer that this seemingly extraneous intelligence is extramundane also, and it will respond to his ideas with the utmost fidelity. Let him believe that he is holding intercourse with Satan, and it will hasten to assure him of the fact, and back up the assertion with profane language; or let him believe himself in communication with some other spirit, celestial or terrestrial, and to the utmost of his own knowledge, possessed or forgotten, will he be humored to the top of his bent. In all this we see just what might be expected from our knowledge, already acquired, of the workings of the passive consciousness. Like clay in the hands of the potter (this simile is appropriate in this particular connection, but it would be far otherwise in a general description of the passive personality), the passive consciousness of the hypnotized subject accepts the part assigned him, and he is equally ready to believe himself a brooding hen or a water pump, and to spread his arms for wings or work them up and down for handles. In relating the few facts which I am about to describe, my principal object is, however, not to sustain or assail any theories, but to stimulate inquiry. My hope is that many persons may be induced to make experiments who at present hold aloof from fear of meddling with what is forbidden, or uncanny, or too serious for what they would deem trifling. In the journal for July I appealed for assistance in these experiments, and from all those whom it reaches I only got replies from two gentlemen, neither of whom, unfortunately, could use the planchette. Is there no one, then, among our seven hundred members and associates who has the gift, and can spare fifteen minutes now and then to make experiments and record results ?

The operator in the following experiments is a young lady, aged fifteen, an inmate of my household, and companion in study with my own daughter. We have, therefore, the best means of estimating her character and her *bona fides*, which, let me say at once, are, we consider, beyond a doubt. She had not previously heard of planchette, and Spiritualism was, to her, a mere name. I took care from the first that no ideas of this kind should be instilled, and she thus approached the subject without any foregone conclusion. Most of the experiments were made with the aid of a planchette. But latterly a pencil was used, held vertically between the points of the fingers and thumbs of both hands, and once or twice the pencil was held in the ordinary way. These changes, however, did not seem to affect the result. The first experiments were attempted by this girl, whom I will call C., in conjunction with her companion, but it soon became evident that the latter was merely a passenger, so to speak, and that C. was the real operator. She was therefore left to write by herself. Unfortunately she looked upon the whole thing as a great bore, and, as I was unwilling to press her, the experiments have only been few and far between. She never knew what she had written till it was looked at, and there was often some slight difficulty in deciphering it.

Thus the first question, Who are you that write? produced what at first I took to be mere scrawling, and C. shortly after left the room. After she had done so I took another look at this scrawl, and then at once perceived that it was legible, and that the name written in answer to the question was "Henry Morton." I at once followed C. upstairs, and asked her if she had ever heard the name, and she replied that it was that of a character in a Christmas play she had acted in, more than a year previously. Had the name, as

[1] Abstract of a paper by Thomas Barkworth in the Proceedings of the Society for Psychical Research, April, 1891.

it easily might have, been that of some deceased friend, it is obvious what inference would have been drawn. I give the next three questions just in the order they followed on the next evening. (2) Why do you write? — A. Because I must. (3) What compels you to write? — A. I do not know. (4) Henry Morton, do you know you are a part of me? — A. Yes, I know.

The last question, being asked in a tone of conviction, amounted to a suggestion, and was adopted accordingly. This docility was illustrated in other ways. For instance, the planchette, having taken to running straight off the paper after completing an answer, was told not to do so again, and at once complied. I should here say that all the questions and instructions to the planchette were first dictated by me and then repeated aloud by the operator.

Some spelling tests followed. C. is not good at spelling, and feels great uncertainty with difficult words. Her voluntary spelling of such is very hesitating, and does not therefore give any suggestion to the passive consciousness. The two personalities acted, therefore, independently of one another, with some curious results. I will give one instance. (7) Spell psychical.

A voluntary attempt was first made. Result: "Sicickle." C. was not told whether this was right or wrong, but was told to try planchette. Result: "Cicicle."

Some questions in mental arithmetic were put, the planchette being instructed to write the answers only, without any calculation. I am informed by her governess that C. has but little arithmetical capability, and is backward for her age in this subject. Bearing this in mind, I think the results were noteworthy. Directly the question was put the instrument began to write the answer. (28) Divide 264 by 16.

First of all an attempt was made to work the sum voluntarily, and, with some delay, the answer given was "17 odd," which was wrong, but on planchette being appealed to it at once wrote "16 and 8 over," which was correct. As we had many instances of the passive intelligence thus excelling the primary activities of the mind, I may take this opportunity of saying that it is quite in accordance with what I had expected, and have elsewhere spoken of, but whether this superiority is essential or accidental, whether, that is, it be due to greater power or to greater concentration, cannot at present be determined, at all events evidentially. (12) Divide 187,981 by 13.— Answer, 14,463.

This is wrong by three only, and, considering the normal powers of the operator above-mentioned, I think it a some what remarkable answer.

I now come to a class of questions designed to test the memory of the passive consciousness. "What happened on the 1st of June?" This question was asked in the last week of July. I chose the date at hazard, and neither C. nor I had any recollection of it. But planchette answered "Went to church," and we then got an almanac and found that the 1st of June was a Sunday. This kind of question was often tried with inconclusive results, but never with incorrect ones, except on one occasion. Being asked in October what happened on the 13th of July, the answer was "Monday lessons." If planchette thought the day was Monday, it is rather curious that it should not have said simply "lessons." In reality, however, the day was a Sunday, and it would be not impossible that C. had during that Sunday been worrying herself about the following day's work. The manner in which the word "lessons" was written was a curiosity. After writing "Monday," the tail of the *y* was brought back with elaborate flourishes, and the first *s* in "lessons" was written; then the *e* and the *l* were written backwards; then the pencil was carried forward with more flourishes and gyrations to the second *s*, followed by the other letters in their order. So florid was all this scroll work that it took much care to find afterwards what route the pencil had taken, though the word was entirely legible.

(14) "Who conquered Peru?" The answer to this was written "Spires," and such an answer being unintelligible, planchette was made to repeat it, with the same result. It then occurred to C.'s governess to fetch the volume of Collier's History which C. had been reading three months previously. At the head of one of the chapters was a table of dates which she had (at the time) learnt by heart, among which were the following consecutively: Reformers called Protestants at Spires, 1529; League of Smalcald, 1530; Pizarro conquers Peru, 1533. The name of Pizarro, which C. had forgotten, is placed in print exactly below the word "Spires," and in this way the two words fell together under C.'s eye, and became indelibly associated in what I have elsewhere ventured to call the pictorial memory of the passive consciousness. The next experiments I shall describe exhibit memory in another aspect. (11) Tell me something I don't know. — A. You have a shot in your eye.

On examination, I found a small blood-speck on the margin of the iris of one eye. This C. assured me she had no idea existed. It is probable, however, that she had at some time seen it in her looking-glass when her mind was occupied with other matters.

(17) Tell me something more. — No answer but scrawling. (18) You must write (peremptorily). — A. Frank Headley ill. (I have altered the name.) In answer to inquiries, C. said this was the name of a boy she had met at the seaside two years before, but she knew no more about him, not even where he lived. Accordingly, the next question was, (19) What is Frank Headley's address? — A. Lord Mayor's-walk.

C., who lived near York, thought there was a street of this name there, but was not sure. It was not till she went home for the holidays that she ascertained, through mutual friends, that Frank Headley went to school in Lord Mayor's-walk, so that planchette was found to have answered correctly. The explanation suggested is, that, when he met her two years previously, he had mentioned this and she had forgotten it. Planchette, however, was unable to give the number in Lord Mayor's-walk, which perhaps he had never told her, and when asked what he was ill with, replied "Cold in head."

Some experiments were made with the right and left hands consecutively; thus, (27) Give the name of one of the principal Elizabethan statesmen. (Right hand answer)—Walpole. (Left had answer)—Walsingham.

The last group of questions asked referred to subjects which it was certain C. did not know and never had known. For instance, "What is the price of Egyptian Unified?" "What is the second Christian name of So-and-so?" etc. Invariably these questions produced no reply; the instrument only made scrawls. It may be possible, however, that had an answer been insisted on, one would have been written (as in the case of Frank Headley's alleged cold in the head), and necessarily an incorrect one, because of the writer's ignorance of the facts, combined with the effects of suggestion compelling an answer of some kind. This I am inclined to think may be the explanation of Mrs. Newnham's answers under her husband's cross-examination (Proceedings, III., 7–23;

"Phantasms of the Living," I., 63–71) — answers which he says were foreign to the conscious intelligence of either of them, and which contained an attempt at deliberate invention rather than plead guilty to total ignorance. If, under suggestion, a hypnotic subject were told to jump over a house, he would not be able to do it, but he would jump as high as he could.

Among miscellaneous questions one only is worth recording. It was, "Are you the spirit of my grandmother?" This was the only time the idea of spirits was introduced, and as it was obviously put jestingly, it did not convey any real suggestion of their agency. The answer accordingly was, "No, I was in ———"; and here followed a remarkably well-executed outline map of Africa, such as few persons, and certainly not C., could have drawn from memory; every important bay and promontory being — as we found on comparison with the atlas — correctly shown, and in due proportion. At one point only was it in error.

The explanation was not that C. was guided by some defunct geographer or Africander, but that she had been getting up the geography of Africa that morning with the aid of the map; and thus had the pictorial memory of the passive personality, unconsciously to herself, recorded, and reproduced this complicated observation, which she had made without effort, and which was merely incidental to her task.

Such are the few and slight experiments which I have ventured to lay before the society. I have done so mainly for two reasons; first, the hope that sufficient interest may be aroused in those who hear of them to induce other and more important essays in this interesting method of investigation; and, second, to indicate the lines on which it may, I think, be most profitably pursued. It would seem that nothing is ever really forgotten, though the bygone memories evoked by pencil, or crystal, may appear so new and strange that we fail to recognize them as ever having been included in our experience.

EXTENSION OF UNIVERSITY TEACHING.

THE American Society for the Extension of University Teaching was founded in response to a deeply felt want for a national association which might assist in promoting the work of university extension.

The friends of popular education feel that the time has come for a better utilization of the facilities for instruction which are to be found in our existing educational institutions.

Our common schools, academies, high schools, colleges, and universities offer good opportunities for an education to those who are able to attend them for twelve or fifteen consecutive years. But the persons able to do this in our communities form a very small fraction of the population. The average child can attend school only four, or at most five, full years, — a period barely sufficient to make a beginning in the rudiments of an education. This is a significant fact, and it justifies the statement that the great mass of the community are in large part cut off from any direct participation in the higher branches of science, for the cultivation of which our advanced institutions of learning are organized.

The credit of recognizing this fact in all its significance, and of determining to change it, if possible, is due to the English universities. In order to test whether it were not practicable to utilize the magnificent facilities of the old English centres of learning for the purposes of popular instruction, a movement was organized to which the name of "University Extension" was given, and which involved sending out lecturers and professors from the universities to give courses of instruction at various places throughout the country. The effort was crowned with success, and has attracted universal attention.

Among the first communities to recognize the possibility for such work in the United States was the city of Philadelphia. For the purpose of testing whether there was a general demand for university extension, a call was issued for a meeting of those citizens interested in the movement. As a result, a local society was organized in order to make an experiment in and around Philadelphia. Having assured itself of the co-operation of the professors of the colleges and universities in or near the city, including the University of Pennsylvania, Princeton University, Bryn Mawr, Haverford, Rutgers, and Swarthmore, the society sent its secretary to England to study the movement there and make a report, and submit plans of organization.

The services of Mr. Richard G. Moulton of Cambridge, England, were secured, and, aided by professors from the above institutions, systematic instruction was undertaken at several different points in November, 1890. The success far exceeded all anticipations. Over forty courses of instruction, embracing two hundred and fifty lectures, were given, with an aggregate attendance of over 50,000, thus surpassing all English records. The demand for courses from a distance was so great that it could not be met.

As a consequence of this experience it was determined to establish a national society to aid in the inauguration and prosecution of this great work, and to do, as far as possible, for the country at large, what the local society has done for Philadelphia. The co-operation of a large number of representative institutions was assured from the outset, and the number of institutions committed to the movement is rapidly increasing.

The American society proposes to collect information as to the experiments now going on in this work in the various parts of the world, and make it accessible to all who are interested in this movement. It will, as far as possible, form branch societies to take up and push the work in and around their localities. It will try to secure a staff of persons trained by actual experience in organizing and lecturing, who may be placed at the disposal of the local societies to assist them in organizing and prosecuting the work. It will strive to make every college and university in the country a centre of university extension.

It is confidently believed that university extension will not only aid greatly the progress of popular education by affording vastly increased facilities for study, but will also benefit the colleges and universities by exciting a wide-spread interest in the work.

The association proposes to publish a journal, to be called *University Extension*, which will serve as a medium of communication between the national society and the local branches, and will give full information as to the progress of the work in all parts of the country.

To do this work efficiently will require large funds. The only sources of income at present are the fees of members ($5 annual fee, $50 life-membership fee) and the voluntary contributions of friends of the movement. The membership fee and all other contributions may be sent, payable to the order of Frederick B. Miles, Treasurer of the American Society for the Extension of University Teaching, 1602 Chestnut Street, Philadelphia. All other communications should be sent to the General Secretary, George Henderson, 1602 Chestnut Street.

NOTES AND NEWS.

BEGINNING with the class entering in September, 1892, the regular course necessary to obtain the degree of M.D. at the Harvard Medical School will be four years. A similar change in the course of medical study is proposed at the University of Pennsylvania.

— Mr. James E. Keeler has been appointed director of the Allegheny Observatory, succeeding Mr. S. P. Langley, secretary of the Smithsonian Institution, who recently resigned the directorship of the observatory.

— The Kenwood Physical Observatory, Forty-sixth Street and Drexel Boulevard, Chicago, will be dedicated on Monday evening, June 15, at eight o'clock. Addresses will be delivered by Professor C. A. Young of Princeton, Professor G. W. Hough, and others.

— A special inquiry was made in the census of last year as to the vital statistics of the Jews in this country. Returns were received from 10,618 Jewish families, representing 60,630 persons.

According to the *Sanitary Inspector*, the death-rate obtained from the figures is one third less for males and one-fourth less for females than among the rest of the population. On the other hand, the marriage and birth rates are low.

— A singlar case of spontaneous combustion is reported, where a painter engaged in a mill removed his overalls at 6 P.M. to go home. At half-past eight the watchman, discovering smoke in the mill, summoned the engineer, and together they searched the premises carefully, tracing the smoke to a small room in which the overalls were discovered, and in one pocket was a bunch of greasy waste that had ignited, showing, says *Architecture and Building*, that spontaneous combustion may ensue in less than three hours if the conditions are favorable.

— It is proposed to hold in the club-room of the Appalachian Mountain Club, Boston, next autumn, an exhibition of botanical specimens, given or loaned for the purpose by members of the club or their friends. All persons who are willing to aid in this matter, whether botanists or not, are requested to communicate with the councillor of natural history of the club, or with Mr. Walter R. Davis of the excursion committee. It is hoped that many specimens may be obtained during the summer, especially of plants distinctly Alpine in habit.

— Professor S. P. Langley of the Smithsonian Institution announces that there has been established, as a department of the institution, a physical laboratory, which has been furnished with specially designed apparatus for the prosecution of investigations in radiant energy and other departments of telluric and astrophysics. The communication of new memoirs bearing in any way on such researches is requested, and for them it is hoped that proper return can be made in due time. All scientific men will rejoice in these improved facilities for the continuance of Professor Langley's famous investigations.

— Bulletin No. 17 of the Kansas Agricultural Experiment Station gives the results of three years' experiments in the artificial crossing of a large number of varieties of corn. The different races — as dent, flint, soft, sweet, and pop corn — were all crossed with difficulty. The effect of the cross was seldom visible the first year, but the second generation showed very generally ears more or less completely blended, often exactly intermediate between the two parental types. The product of the third year is generally true to the seed planted; that is, by selecting diverse grains from any ears, ears are obtained with grains usually like those planted. Any desired form of a cross can therefore be perpetuated.

— A letter lately received from Emin Pasha by one of his ornithological correspondents in Europe is dated from one of the larger islands on Lake Victoria Nyanza in November last. According to *Nature*, it is full of details about birds, in which, as is well known, the Pasha takes the keenest interest, and alludes especially to an apparently new *Gralline* form, with three toes, met with in that district. Emin was on the point of starting southwards into the territory near the north end of Lake Tanganyika, and is now probably somewhere in that little-known country. He had been joined by Dr. Stuhlman, a young naturalist of Hamburg. Dr. G. Hartlaub of Bremen has just published a memoir on the birds collected by Emin during his return to the coast with the Stanley expedition and his subsequent sojourn at Bagamoyo. The specimens are referred to 140 species, of which eight are described as new to science.

— The curve shown by the graphic daily record of the magnetic declination, or variation of the compass, at Washington during the exceptionally severe magnetic storm that occurred about the middle of May, is of special interest. Beginning at 7 A.M. on the 13th, the magnetic disturbance attained its maximum between 6 and 11 P.M. of the following day, and again between 4 and 10 A.M. of the 15th, not finally ending until the 18th. During this storm the direction of the magnetic needle changed 48′ in 9½ hours. A correspondingly large disturbance was indicated by the instruments registering the horizontal-force component of the earth's magnetism. A marked feature of the storm was an oscillating movement of the north end of the magnetic needle to the eastward, attaining a maximum departure from normal of 35′ on the 14th, between 6 and 11 P.M., accompanied by a large decrease in the horizontal-force and increase in the vertical component. During the afternoon and evening of the 15th the north end of the needle was deflected to the westward, accompanied by a decrease of horizontal force even greater than during the evening of the 14th, and a corresponding decrease in vertical force.

— Serafini and Arata have made some investigations to determine the correctness of the belief that the foliage of trees has some influence in filtering out the bacterial contents of the atmosphere. Their method of procedure, says the *Sanitary Inspector*, was to determine the number of bacteria in air under motion before and after it had reached the woods. The barometrical pressure, direction and strength of the wind, temperature at the edge and in the midst of the woods, humidity and rainfall, were all taken into consideration. As the number of observations was only forty, the investigators give the results with some reserve, nevertheless they believe that they are justified in affirming that forests do exercise the power of straining out the bacteria that are brought to them by the wind.

— Mr. C. Powell Karr, an architect of New York City, has extended his courses of home study in architecture. The instruction is conducted by mail. When these courses were initiated in 1887 they were established to aid young men and women, who, while holding a preference for architecture over its sister arts, have been denied an early opportunity of preparing themselves for their chosen work. At the present time, when so many universities have thoroughly organized and flourishing architectural courses, it would seem almost superfluous to supplement them by such a series of courses, but there is a great advantage in entering the collegiate life well equipped and thoroughly enlightened, and many have availed themselves of this system. It has been found also that there are a limited number of young men and women who are now engaged in pursuits allied to architecture who could and would avail themselves of these courses, and for them especially the revision has been made, the courses expanded and made individually applicable to the advancement of their professional and business interests. Among the students are found carpenters, masons, builders, contractors, professional draughtsmen, architects' superintendents, and even practising architects themselves. Architects have been quick to respond to the advantages offered them by the course in architectural engineering, as they feel the necessity of being in touch with the practice of the profession in the metropolis, and of having a living reference upon questions of difficult construction or technical procedure that may arise at a moment's notice.

— The evil repute of the cat still clings to him, says the *Illustrated American*. A Finisterre cat which has served nine masters in succession is believed to have the right of carrying off the soul of the ninth to hell. In Upper Brittany there are sometimes seen enormous cats engaged in holding a meeting. If any one presumes to intrude upon their presence, they surround and tease him for a time. Then a long needle is driven into his heart and he is dismissed. Hypochondria ensues, and he slowly wastes away. A black tom-cat, says a Russian proverb, at the end of seven years becomes a devil. A Breton farmer, who neglected to take the usual precaution of putting his tom-cat to death before it completed its seventh year, was found dead in bed one morning, with his throat terribly torn. Suspicion fell upon innocent persons, who were likely to be hanged on circumstantial evidence. Luckily, a boy observed that the cat of the house was always watching the corpse with eyes that blazed with rage. So he fastened to the dead man's arm a string, the end of which he dropped through the window into the yard. Then he told the police to watch the body secretly, while he pulled the string. They did so. When the boy gave the string a pull, the corpse's arm jerked. The cat imagined its master had revived. With one bound it sprang upon the bed, and furiously tore away at the corpse's wounded neck. Whereupon it was condemned to be burned alive, and the suspected persons were set free. It is believed that a cat's viciousness depends to a great degree upon the length of its tail. If the end of its tail be cut off, it is unable to take

part in the witch's *sabbat*. When a Walloon maiden wishes to refuse a suitor with contumely, she gives him a cat, and tells him to count its hairs. It is generally believed in France that a bachelor who treads on a cat's tail will find no woman to marry him till a full year has passed by. In Germany, in England, and in France many a religious *fête* of the middle ages culminated in pitching a cat off a height or into a bonfire. Indeed, as recently as 1818 a decree was issued at Ypres, in Flanders, forbidding the throwing of a cat off a high tower in commemoration of a Christian festival. Fontenelle told Moncrif that he had been brought up to believe that not a single cat could be found in town on the eve of St. John's, because they all went on that day to the witches' *sabbat*. It is readily intelligible from this why the people on that day threw into the fire all cats that were foolish enough to be caught. They actually believed that in doing so they were ridding the country of sorcerers.

— That the possibilities of agriculture in all parts and altitudes of Wyoming may be fairly tested, the trustees of the Agricultural Experiment Station of that State have established experiment farms in several different places. The west-central portion and the altitude of 5,500 feet above sea-level are represented by the Lander experiment farm of 137 acres, under irrigation, in Fremont County. The Laramie plains and the altitude of 7,000 feet are represented by the Wyoming University experiment farm of 640 acres, irrigated, in Albany County. The North Platte valley and the altitude of 6,000 feet are represented by the Saratoga experiment farm of 40 acres, Carbon County, irrigated. The northern part of the State and the altitude of 4,000 feet are represented by the Sheridan experiment farm of 50 acres, under irrigation, in Sheridan County. North-eastern Wyoming, with the greatest rain-fall and the altitude of 4,500 feet, is represented by the Sundance experiment farm of 49 acres, to be carried on without irrigation, in Crook County. South-eastern Wyoming, the Sybille valley, and the altitude of 5,000 feet, are represented by the Wheatland experiment farm, irrigated, in Laramie County. As the report of the Governor of Wyoming for 1889 shows that four-fifths of the State is between the altitudes of 4,000 and 8,000 feet, it is evident that the farming and grazing lands of Wyoming are now well represented. As soon, however, as the funds will permit, it is intended that other experiment farms will be established.

— Bulletin No. 14 of the Missouri Agricultural Experiment Station is devoted to a report on experiments with corn made in 1890. In these experiments a trial of deep and shallow tillage gave an increase of over fourteen bushels per acre, or twenty-one per cent of the entire yield, in favor of shallow tillage in 1889, and nearly thirteen bushels, or thirty per cent of the yield, in 1890. The implement used for shallow tillage was made expressly for this experiment, and has a number of knives running an inch or more under the surface, loosening the soil and effectually destroying weeds in its path, but not lifting the soil sufficiently to cover the weeds in the hill unless quite small. The Illinois Experiment Station at Champaign has made similar experiments, in which the average increase in favor of shallow culture was nearly eight bushels per acre over a period of three years. The Ohio Experiment Station has conducted similar experiments, using a cultivator not so well adapted to the purpose as the one described, but with results also in favor of shallow tillage. The Missouri bulletin, already quoted, also reports a series of experiments instituted for the purpose of determining the most profitable amount of culture for corn. The results of these experiments, and they are in harmony with similar tests made at the experiment stations of Illinois, New York, and Ohio, indicate that nothing is gained by cultivating incessantly. If the weeds are kept down and the ground is cultivated sufficiently to prevent a hard crust forming, two or three workings will produce as large a yield as half a dozen.

— Recent experiments in the laboratories of the Johns Hopkins University have shown that in one gram of loamy soil there are 8,740,000,000 particles. To the surface of each of these minute particles a thin film of moisture adheres by capillary attraction. The tips of the rootlets of plants have the power to absorb this hygroscopic water with the substances it holds in solution. The spaces between the particles of soil should be filled with air. If filled with water the plant will be killed by drowning. These experiments are of special interest in Wyoming, where soggy soil is rare, and the thickness of the film of moisture on the soil particle is the vital problem. Further experiments in the laboratories named have shown that certain alkalies have the power to thicken and retain the film of moisture on the soil particle. Experiments with these chemicals are being tried on the University experiment farm and grass fields of Wyoming, under the direction of Dice McLaren, in the hope of good results to the arid soils of that State. Gypsum and many other crystals have the property of absorbing and retaining vast amounts of moisture. It is probable that the rootlets of plants have the power to absorb this water of crystallization. Researches on this point are in progress at the station. Among the subjects used are ground gypsum and calcined gypsum. In moist climates gypsum is used as a reagent to set free the potash, nitrates, and phosphates in the soil. In the dry climate of the West gypsum may be found to have the further merit of absorbing water in wet times and of retaining it for the use of plants in dry times. In this connection experiments will be tried at the station with many native phosphates, nitrates, and other fertilizers, and with the waste products of glass and soda works.

— The other day, says *Nature* of May 28, Professor Vambéry delivered in Edinburgh, under the auspices of the Royal Scottish Geographical Society, an interesting lecture on British civilization and influences in Asia. He had many pleasant things to say about England, but did not quite overlook her shortcomings. He said he was immensely struck by the indifference shown by the public at large to every thing that concerned Asia. He had lectured in more than twenty towns in England, and found, even among the middle classes, great ignorance in regard to Asiatic geography and ethnography. Asiatic languages, moreover, were greatly neglected. Germany, which had not got any territory in Asia, bestowed far greater attention upon the old world than England. He opined that if the interest in Asia would increase in England commensurately with its political power and influence over the various races in Asia, Britain would decidedly remain there a permanent power which could never be ousted by any rival. He thought that there ought to be more schools for oriental languages in England. There was a general supposition that Britons in general could not learn foreign languages, but that was not true. The greatest linguists of our age had been British, as, example, Lord Strangford for Turkish, and the late Sir Richard Burton and the late Professor Palmer for Arabic. Then there were scholars like Sir James Redhouse, Sir Henry Rawlinson, Sir William White, and many others, bearing evidence of the brilliant linguistic capacity of the British. He believed that nothing could be easier than to recruit in England a goodly number of oriental linguists for employment in various Asiatic countries.

— In a communication to the New York *Sun*, not long since, Mr. George F. Kunz, the well-known expert in gems, called attention to a property of the diamond which may serve as a means of distinguishing it from other substances. Referring to the paper of Robert Boyle "On a Remarkable Diamond that Shines in the Dark," published in the "Transactions of the Royal Society" in 1668, Mr. Kunz remarks that this paper has been indirectly alluded to by a number of authors, but never read. Among a number of other facts, Boyle mentions one diamond that phosphoresced simply by the heat of the hand, absorbed light by being held near a candle, and emitted light on being rubbed. He stated that many diamonds emitted light by being rubbed in the dark. The experiments made by Mr. Kunz show conclusively not only that Boyle's statement that some diamonds phosphoresce in the dark after exposure to the sunlight or an arc electric light is true, but also that all diamonds emit light by rubbing them on wood, cloth, or metal, a property which will probably prove of great value in distinguishing between the diamond and other hard stones, as well as paste, none of which exhibit this phenomenon, and will be welcomed by the general public who do not possess the experience of the dealer in diamonds. The property is evidently not electric, or it would not be visible on being rubbed on metal.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

THE ACTUAL NUMBER OF TUBERCLE BACILLI WHICH MAY BE PRESENT IN TUBERCULOUS SPUTUM.

DR. GEORGE H. F. NUTTALL of Johns Hopkins University, in the last number of the "Johns Hopkins Hospital Bulletin,"[1] describes at length a method by which he has been able to make accurate estimates of the actual numbers of tubercle bacilli present in tuberculous sputum. His communication is accompanied by cuts of the apparatus used. The methods heretofore employed for estimating simply the relative number of tubercle bacilli in sputum are condemned as unscientific. Nuttall's observations for the first time give us an idea of the enormous number of tubercle bacilli which a patient may expectorate in the course of twenty-four hours.

In three cases undergoing the Koch treatment observations on the numbers of bacilli in the sputum were made every few days. In the first case the patient expectorated two billions of tubercle bacilli during the twenty-four hours; after the patient was inoculated with tuberculine the number of bacilli rose to three and four billions; after the inoculations ceased the number fell again to two billions.

In the second case the number of bacilli in the sputum varied between twenty and one hundred and sixty-five millions on the days preceding the Koch inoculations, rose irregularly to two hundred and eighty-three millions after the first inoculation, and fell to only two hundred and sixty-five thousand by the time the sixteenth inoculation had been reached. The third case showed a decrease from seventy millions before the inoculations to twelve and nineteen millions after treatment had commenced.

A great rise in the number of tubercle bacilli in sputum was observed in one case (which was not undergoing the Koch treatment) to occur simultaneously with the appearance of elastic tissue. The number of bacilli in this case rose from between three and four hundred millions to over four billions.

[1] A Method for the Estimation of the Actual Number of Tubercle Bacilli in Tuberculous Sputum. With a Note on the General Application of the Method to Bacteriology. By George H. F. Nuttall, M.D., Ph.D. (Göttingen). Reported before the Johns Hopkins Hospital Medical Society, April 6, 1891.

The accuracy of the method is shown by a number of control and culture experiments. Nuttall believes his method will prove valuable in any experiments where it is desirable to introduce a definite number of organisms into culture media, disinfectants, etc. In point of accuracy it far surpasses the loop method generally employed. With such organisms as the tubercle bacillus this method will enable the experimenter to determine the number he is inoculating into an animal in a way that has not been possible hitherto. Inoculations made under such conditions will clearly show the difference in degree of virulence possessed by various organisms, as also the relation between the number of bacteria introduced and the progress of the disease. This method finally brings us a step nearer to solving the problem of the significance of involution and degeneration forms of bacteria.

COLOR-PHOTOGRAPHY.

AT the reading of a paper on "Chromo Photography in Practice," by Leon Vidal, before a recent meeting of the Photographic Society of Great Britain, in London, a collection of photo-mechanical pictures in color was shown, from different countries, and made by different processes. According to the *British Journal of Photography*, the majority of the examples shown were far in advance of anything of the kind produced heretofore.

The journal mentioned goes on to say that the majority of the pictures are produced by methods analogous to ordinary chromo printing processes, inasmuch as different matrices are used for the different colors. The printing plates or stones being made more or less by the aid of photography, as an incentive to experiments in this direction, the journal indicates some of the methods by which prints in color may be obtained, and probably the ways by which the majority of those exhibited were made.

In 1876 M. Ducos Duhauron patented a method which he termed "photographs in colors." His method was to obtain three negatives of the subject, one by green light, another by yellow, and a third by violet light, by means of colored screens; aurine, eosine, and chlorophyl being employed as different color sensitizers. From the three negatives thus obtained prints were made on semi-transparent media, prepared with the complementary colors, and then superimposed on each other. The late Mr. W. B. Woodbury devised a process for producing prints in color. It was this. He made a Woodbury print on paper which had previously had the appropriate colors printed upon it by lithography. By this process Léon Vidal, some years ago, produced some excellent work, and evidently does so still, as proved by the specimens exhibited.

Another plan is to take three or more negatives of the same subject, and then stop out by hand in each certain portions representing the various colors, finally using these negatives to prepare printing plates or stones for successive printings, as in the case of chromo-lithography. By this system chrómo-collotypes have long been made.

Messrs Goupil & Co. have for some years past been producing photogravures in colors in one printing from a single plate. The method is this. The intaglio plate is inked in with different colored inks applied locally as required. This method is a somewhat tedious one, and necessarily requires considerable artistic skill on the part of the printer. Notwithstanding this, the firm have shown many excellent examples from time to time in the exhibitions of the Photographic Society. Instead of applying different colored inks on the same plate, it is obvious that separate intaglio plates can be prepared for the different colors and used for separate printings.

In his paper Léon Vidal alluded to the original method of superimposing a Woodburytype in monocrome on paper printed with suitable colors by lithography, and also treating similarly printed paper by imposing upon it a collotype print, as being the best in practice. He also expressed the opinion that the claims, which had been put forward by some, that the effects of nature could be obtained by the photographic selective character of the negatives

only, without the necessity of retouching or masking, could not be sustained.

One of the cheapest processes of chromo-photography is that of printing from half-tone relief blocks. Several examples by this method were shown in the exhibition. The blocks may be made from different negatives, representing the different colors, as in other processes; or they can all be made from a single negative, afterwards cutting away certain portions corresponding to the colors not required in that particular block.

THE EGG-PLANT.

THE egg-plant seems to have received little systematic attention, either from gardeners or students. Yet it is an important and interesting plant, and there are indications that it can be considerably modified by treatment. This is clearly shown by the results of studies and experiments made at the Cornell University Agricultural Experiment Station, by L. H. Bailey and W. H. Munson, and given in detail in Bulletin No. 26 of that station. Their studies of the egg-plant began five or six years ago, but three years were consumed in learning how to grow it. During the last two years they have grown all the varieties procurable in this country, in France, and in Japan.

The chief difficulty in growing the egg-plant in the North is the shortness of the seasons. It is only by starting plants early and maintaining a vigorous growth that the large sorts can be fruited satisfactorily. The plants should be started under glass from the middle of March to the middle of April in a warm house. The chief cause of failure during the early experiments was the lack of a good forcing house. In the cold and small house at the disposal of the experimenters the plants grew slowly, and when set out of doors they were not of sufficient size and vigor to begin bearing at once. The seed is sown in "flats" or boxes, and when the first true leaves are about half an inch in diameter — which is about a month after the seed is sown — the plants are pricked off into two-inch pots. As soon as the pots are filled with roots, the plants are shifted into four-inch pots. Indifferent success was met with in transplanting into other flats, as the plant is most severely checked when placed in the field, from the greater injury to the roots. It is imperative that the plants should not become "drawn." The plants are transferred from the four-inch pots to the garden from the first to the middle of June. The early sorts are not so seriously injured by a check in growth as the large and late sorts, and they can therefore be handled with less care. These sorts can be started two weeks later than the others and receive but one transplanting. The effects of early and late setting are shown in the following experiment.

Seeds of several varieties were sown March 27 and May 15. On the 7th of September they presented the following differences: long purple, giant round purple, and long white from early sowing were productive, but few or no fruits had formed on the plants from late sowing. Early long purple and round white from the late sowing were fully as productive as those from the early sowing. Early dwarf purple gave best results from plants started April 15. This shows that there is little or no gain in productiveness in the small early sorts from very early sowing, while the large sorts profit by it. The black Pekin, which is one of the large varieties, proved an apparent exception, however. Plants started May 1 gave better results than those started earlier, but neither lot was satisfactory. The unsatisfactory results from the early sowing may have been due to the loss of the first flowers because of the transplanting. Transplanting usually has the effect of keeping plants growing, to the detriment of the flowers; and egg-plants which are in bloom when removed to the field are apt to drop the flowers. It is important in the large sorts to induce the first flowers to set.

The best soil for egg-plants is a heavily-manured rich sandy loam, — not too light, — which contains an abundance of humus and retains moisture. The large kinds were set three feet apart each way, although they can be set somewhat closer if land is very valuable. The ground should be thoroughly cultivated throughout the season. The patches were run through lightly with the cultivator at least twice a week.

The worst enemy of the egg-plant is the potato beetle, which prefers egg-plants to potatoes. The egg-plant grows slowly, and any injury to the young plant is overcome with difficulty, if at all. If the plants are seriously injured when first set out there will be little use in attempting to fruit them, especially the large kinds. Paris green, one pound to 100 gallons of water, is used for spraying.

It is rare that all the plants in a large plantation of the common or late varieties mature fruit, and such kinds as black Pekin, New York, and giant round purple rarely mature more than two large fruits to the plant in the latitude of the station, and often only one. The early dwarf purple, early long purple, and other early and medium varieties, mature from four to eight fruits without difficulty. The value of any of the late varieties depends very largely upon the uniformity with which all the plants in any lot set and mature fruit. The value of continuous and careful selection to this end was illustrated in the behavior of a large plantation of crosses last year, in which a large percentage of the plants were entirely unfruitful, showing that a promiscuous lot of seedlings is likely to be unproductive; and in this case these were crosses between productive parents. Breeding plants of uniform productiveness is the most important field in egg-plant experimentation at present.

The results of the experiments may be summed up as follows: (1) Egg-plants are adapted to cultivation in the North. The requisites of success in growing them are these: early starting; warm quarters; vigorous plants; rather late transplanting to the field; warm, rich, and rather moist soil; constant attention to potato beetles; frequent cultivation. (2) The best varieties for private use are early dwarf purple, early long purple, white Chinese, with perhaps black Pekin for late. (3) The best market varieties are New York improved and black Pekin, with perhaps early long purple for the first demands. (4) In crossing different races of egg-plants, the purple-fruited types appear to be stronger in their power to transmit color to offspring than do the white-fruited types; and this appears to hold whether the purple type is used as the staminate or the pistillate parent. (5) The white-fruited types appear stronger in the power to transmit form and productiveness. (6) Fewer seeds are produced by flowers artificially pollinated than by those left to mature, even though an excess of pollen is used. (7) It is probable that the egg-plant may be included among those plants which are capable of producing fruit without the aid of pollen.

As some of the neglect of the egg-plant is doubtless due to the fact that cooks are not familiar with it, the following recipes for cooking the fruits are recommended by the experimenters at Cornell as reliable. (1) Cut in slices crosswise, not over a half inch thick, and parboil in salt water about fifteen minutes; then remove, and fry in a hot spider in butter and lard. (2) Cut into slices a quarter of a half inch thick and lay in strong brine for two hours; then wash very thoroughly; sprinkle with brown sugar, pepper, and salt, and fry slowly to a dark brown (3) Cut in two lengthwise, remove the seeds and pulp, and fill with dressing made of half a teacupful of bread crumbs, one teaspoonful of butter, and salt and pepper to taste; lay the halves side to side in a dripping pan, add a little water, and bake nearly an hour. (4) Pare, cut in thin slices crosswise, and soak in salt water for eight or ten hours; dry on a towel, dip in beaten egg, and roll in bread crumbs, then fry slowly in hot butter until the pieces become a rich brown; serve hot.

THE LOCUST PLAGUE IN ALGERIA.[1]

ON the 13th of May last I was travelling with my husband through eastern Algeria. At six o'clock on a lovely summer's morning we had taken the train from Algiers, making our way along the shores of one of the most beautiful bays in the world, its blue waters shining in the early sunlight beneath the wooded heights of Mustapha, studded with its white Arab villas. We had left behind us the Maison Carrée, where Cardinal Lavigérie's Pères Blancs make the best of both worlds in manufacturing excellent wines, and in preparing for their life of self-denial in the Sa-

[1] Evelyn Frances Bodley in the Contemporary Review for June, 1891.

hara. By nine o'clock we had reached Ménerville, where the fertile plain of Métidja ends, and the mountain country of the Kabyles begins. We were toiling up a steep ascent, when the order was given for all the passengers to alight. There had been a landslip, making the passage of a viaduct dangerous, so we had to get out and walk across it while the train cautiously followed us. Suddenly a cry was raised: "*Voilà, les sauterelles*," and there before us, in the transparent air, looking like a summer snowstorm, we saw approaching a dancing cloud of winged particles. It was the advance guard of the dreaded locust army marching on Algiers.

For weeks nothing had been talked about in the neighborhood of my old home but "*les sauterelles*." Everybody, French, English, or Arab, who owned a vineyard, or even a garden, was calculating the chances of the approach of the invading scourge, sometimes in a manner not intelligible to strangers. There was a lady not long arrived from England, whose knowledge of French was limited, and who asked me: "Who are these people, the Sauterelles, of whom every one is talking, but whom I have not yet met?" The day before starting on our journey I had been present at a wedding at one of the loveliest villas in Mustapha, to which the governor-general, Monsieur Jules Cambon, had come, on the very morrow of his arrival, to show his regard for his English friend, the bridegroom. When it was rumored that his excellency had accepted the invitation, all the well-informed declared that the new governor could not possibly be fulfilling social duties, when the locusts had appeared at St. Pierre-St. Paul, thirty-five kilometres distant from the capital. As a matter of fact, Monsieur Cambon, with the energy which characterizes that most amiable and distinguished Frenchman, after assisting at the wedding, set out, twenty-four hours later, on a tour of inspection of the ravaged districts, and I only mention this incident to show how the advance of the locusts was the sole absorbing topic of the hour in Algeria.

Here at last we were face to face with, or rather surrounded on all sides by, the devastating hordes. The railway crawls up the Kabyle hill country, through a succession of gorges, interrupted here and there by a tunnel, and sometimes the line skirts the cliff-side, hanging on a terraced ledge over a rushing river of the color of *café au lait*. The mountain defiles are thick with the flight of rushing insect life, but here in these barren passes there is nothing for them to prey upon, only a tuft of cactus here and there perched on the side of a torrent, or a solitary cluster of acanthus. But now the hills recede, and we are once more in the fruitful plains. How can I describe the glories of early summer in Algeria? English tourists come in the winter, and leave in the spring, taking away an impression of rare hours of sunshine, scattered among days of storm, and of scirocco, and sometimes, as this year, of snow; but it is in May that the full beauty of northern Africa comes forth in its wealth of flowers. We were now passing through a valley bounded by majestic snow-crowned heights, which appeared literally to be carpeted with a luxuriant growth of gorgeously tinted flowers — yellow marguerites, white and pink cistus, scarlet poppies, purple orchids, crimson gladiolus, and blue convolvulus — and sailing above this gay ribbon border of the fresh green of the vineyards, sped along the fluttering host of locusts, farther in all directions than the eye could reach. It seemed like a never-ending swarm of bees, bees as large indeed almost as skylarks, or at all events as humming-birds, but instead of bringing with it the proverbial luck of "a swarm of bees in May," it was carrying in its wake ruin and despair to the Mussulmans of the soil and their Christian conquerors.

It is popularly supposed that the locusts eat their way from place to place, and that the whole region through which a flight of them has passed is left devastated and bare. We saw no trace of the passage of the plague on our way, and, as a matter of fact, the locusts in their progress do comparatively little harm. The mischief is done when they settle and lay their eggs, which, when hatched, bring forth myriads of young — "*les criquets*," and it is they which eat up the land. . . . It is difficult without seeming to exaggerate, to attempt any estimate of the countless myriads of *criquets* which are produced by the *sauterelles*. I will only mention one example, which may afford some idea of their numbers. In one commune alone during the last two months the weekly destruction of eggs has amounted to from eighteen to twenty millions.

Some years ago, when I was very little, I remember seeing a flight of locusts on the Mediterranean as we neared the coast of Algeria on the voyage from Marseilles. My childish recollection of it was that in the distance we saw a dense cloud approaching, and that when the ship passed through it, we seemed to be enveloped in a London fog for the space of several minutes. I have often thought that my young fancy had exaggerated the phenomenon, but though the swarms we passed through to-day were not densely packed, the numbers we encountered must have immeasurably exceeded the mass which I then saw flying across the sea from headland to headland. From Ménerville to Bouira is a distance of seventy kilomotres — between forty and fifty miles — yet never once was there a break in the procession. I had a reason for gazing attentively through the carriage windows. When I was seven years old I had driven by my father's side, in the days before railways were thought of in the Kabyle country, and as we approached the village at sunset, we saw a lion drinking at a stream. That is fourteen years ago, and it makes me feel a very ancient inhabitant of Algeria to think that I have seen, as a not extraordinary incident of a peaceful drive, a lion, which the most intrepid hunters have now to penetrate far into the heart of Africa to get a shot at.

After Bouira, as we approached the Department of Constantine, the locusts disappeared, and the next morning, in the picturesque capital of the eastern province, we could not find a line about the *sauterelles* in the curious little sheets, half a dozen of which do duty as journals in every town of Algeria. Nothing of greater interest was paragraphed than the visit of Admiral Duperré and the officers of the fleet from Philippeville to the old Roman fortress, and the complimentary remarks of Lieutenant Viaud (better known to the world as Pierre Loti) about the incomparable site of the rocky ramparts towering above the abysses of the Roumel.

A day later we went on to Hamman Meskroutine, where are the famous hot sulphur springs which rush steaming from the earth, forming cascades over petrified terraces of the dazzling whiteness of alabaster. Just as we were driving along the flower-bordered road which leads to this most beautiful sight, against a thunder-cloud which hung threateningly over the mountains, we espied between us and the dark background thousands of yellow flecks — they were our friends, the locusts, again. This lovely spot is in the midst of a vine country. Though the land was in full beauty, it was too late for tourists, and every one we saw there was connected more or less with the locality, from the Jewesses, in their grave mediæval costumes, come from Constantine or Tunis for the baths, to the small French proprietors, who sat round us at the *table-d'hôte*; and every tongue sounded the voice of lamentation at the appearance of the pest.

It was no passing cloud, as we realized the following morning, when we went on by train towards the frontier of Tunisia. The railway carriages of the Chemin de Fer de l'Est-Algérien are fitted with a little gallery which runs the length of the compartments, and very amusing it is to sit and watch the passengers lolling or promenading, especially as a large proportion of them are grave Arab chiefs, of charming manners and of splendid presence, in their graceful burnous. To-day the sons of the desert laid aside some of their dignified impassiveness, for no sooner had we started than we found ourselves among a host of locusts. It will hardly be credited when I say that far above the clatter of the train was heard the whirr of the countless wings. We passed through a mountain valley about a kilometre in width, and the whole expanse seemed blocked with the clamoring mob of insect life, and when the valley widened out into the fertile vine-clad plains that stretch around Guelma — where a generation ago Gérard, the renowned *tireur de lions* commenced his fame — as far as our sight could travel danced in the sunlight the yellow phalanx.

Algeria is so familiar to me, who have spent in that country nineteen out of my twenty-one winters, that I do not know if it be necessary to describe the geographical situation of the places I have mentioned, and of other localities ravaged by the locust plague. The three departments of Oran, Algiers, and Constantine, which compose the colony, stretch from Morocco on the west to Tunisia on the east, the city of Algiers standing about half-way

between the two boundaries, and the whole coast-line being about a thousand kilometres in length. The whole of this wide expanse is threatened by ruin, ruin compared to which the ravages of the phylloxera are mild. The last news which we had from the western province was that around Tlemçen, on the frontier, flights of locusts were alighting unintermittently, and that a caravan just arrived there from Morocco had travelled for thirty-two days in the midst of locusts, the country being entirely devastated. I have said enough to show how the central department of Algiers is threatened, and now on the borders of Tunisia, advancing from the east, we had met once more with the dread hordes. The night before our arrival at Bône, the frontier port, a train coming thither from Tunis had been actually blocked for half an hour by a swarm at a little place called Oued-Zerga, and in the capital of the Beys the natives were trying to make the best of the plague by cooking and selling the *sauterelles* for food.

I have not the space, even if I had the technical knowledge, to describe the means by which Algerian cultivators are trying to stay the pest; how they set about the unpleasant work of destroying the eggs, and how, after incubation, they devise methods for stopping the march of the *criquets*, which, if unchecked, literally eat their way along, leaving the most verdant and fertile tracts a brown wilderness. Suffice it to say, that not only are the local authorities, the maires, and sous-préfets, organizing resistance and raising subsidies for the struggle, but, what is more significant in a territory which is above all things a military training-ground for France, the general commanding the forces in Algeria has granted a remission of thirteen days to all cultivators called to serve with the colors, whose properties are menaced by the locusts.

My last glimpse of the country, which I have the greatest reason for loving that a woman can have, was across the vineyards whose leafy lines stretch in never-ending vistas over the rich plains by the Tunisian frontier, and I thought of the sinister Arab prophecies which foretold that, after the conquest by the Franks of this fair land, an army of invaders, worse even than they, should come up from the desert, and extend the boundaries of the Sahara to the shores of the Mediterranean.

VARIETY AND PLANTING OF CORN.

BULLETIN No. 15 of the Pennsylvania Agricultural Experiment Station is a report of experiments on the influence of variety and the rate of seeding on the yield of ensilage corn. Two varieties of corn were planted, one the field corn ordinarily grown in that locality, the other Breck's Boston market ensilage, a large-growing variety which barely reaches the glazing stage before frost in that locality. Both varieties were sown in duplicate plots, of two rates of seeding each, the plots being alternated. The rows were three and a half feet apart, with guard rows between the plots, so that the ground was all equally occupied. Manure was applied liberally, but by a mistake the thick-seeded plots received larger quantities of manure as well as of seed. The thin-seeded plots were planted so that the stalks stood fourteen inches apart in the rows, while on the thick-seeded plots the stalks were three and a half inches apart.

The average yield of each pair of plots, calculated to one acre, was: small, thin-seeded, 11,962 pounds; small, thick-seeded, 19,-018 pounds; large, thin-seeded, 20,955 pounds; large, thick-seeded, 26,840 pounds. It appears, therefore, that the larger variety gave a decidedly larger yield than the smaller one, and that thick seeding was decidedly more profitable than thin seeding.

Chemical analyses were made of samples from the various plots, from which it appeared that the produce of the larger variety and of the thicker seeding showed even greater superiority than that indicated by the gross yield.

Experiments similar to the foregoing have been conducted at the Ohio Experiment Station over several seasons, and these have uniformly showed a larger yield, both of grain and fodder, and therefore of food for animals, when the corn was so planted that the stalks stood about six inches apart in rows about three and a half feet apart, than when the distance between the stalks was greater. As between planting six inches apart and three inches apart, the Ohio experiments show better results from the six-inch planting.

Such close planting as this causes the ears to be chiefly nubbins, and therefore it is not to be recommended when merchantable grain is the product desired; but for silage purposes it is not necessary that the grain should be merchantable.

THE TRANSANDINE RAILWAY.

THE Transandine Railway now in process of construction across the Andes Mountains, for the purpose of connecting the railway systems of Chili and the Argentine Republic, is an enterprise involving many engineering difficulties. London *Engineering* has devoted considerable space to a series of illustrated articles on the railway and its construction, from which we gather the following facts.

The length of the new railway is 149 miles, of which 109 miles are on Argentine territory, starting from the city of Mendoza, which is 2,876 feet above the sea. In Chili there are forty miles, connecting with the Chilian system at Santa Rosa, 2,704 feet above sea-level. The greatest height attained by the railway is 10,460 feet above sea-level, the tunnel at that point being some two thousand feet below the summit of the mountains. There are eight tunnels grouped near the summit, aggregating 9.32 miles in length, the longest, the summit tunnel, having a length of 5,540 yards. To overcome a part of the difference in level within a short distance, and at suitable working gradients, it has been found necessary to construct a spiral tunnel 2,061 yards long, with a radius of 200 metres and a grade of eight feet in a hundred. It may be added that this grade is maintained through the whole nine miles of tunnelling, except, of course, in the summit tunnel.

It is in the boring of these tunnels that the greatest engineering difficulties are encountered. The absence of fuel, and the enormous expense of obtaining it, put steam out of the question as a motive power for driving the air compressors,— air-actuated drills being the means employed for boring the tunnels. Water power, the only other means available, was to be had, but at a considerable distance from the work. It was therefore decided to use the water-power for driving electro-dynamos, transmit the electric current by copper conductors to the sites selected for the compressors, convert it into power by means of electro-motors, thereby actuating the compressors and furnishing compressed air for the drills. The installations for this purpose are unique, as it is probably the first time that the power for compressing air for drills has been conveyed such a distance by electric cables. There are three installations, one upon the Argentine and two on the Chilian side of the Andes, each being distinct in all points, except that the primary stations on the Chilian side are both located at one place. Each installation has a primary station, where the turbines and dynamos are situated, and a secondary station, with electro-motors and air compressors.

The Chilian installation consists of two primary stations under one roof at Juncal, with secondary stations at Juncalillo and Calavera, and separate cables for transmitting the current. The power for driving the turbines is obtained from the Quebrada Juncalillo, the water being conveyed to the turbines, a distance of 1,420 yards, by a double line of steel pipes. The primary station at Juncal for the Juncalillo station consists of six Girard turbines, each giving 80 horse-power, a total of 480 horse-power. Each 80 horse-power turbine is coupled directly to the shaft of an 80 horse-power dynamo, consequently there will be no loss of power in transmission from the turbines to the dynamos. The latter are grouped in two groups of three dynamos each, each group having a main and return transmission cable. A great advantage is gained in having two groups, as should accidents or other cause prevent one from being worked, the whole of the tunnelling would not be stopped. At the secondary station at Juncalillo, about 3,281 yards from Juncal, the power available is 401.8 horse-power, cables being attached to six electric motors, similar to the 80 horse-power dynamos, which drive six air compressors.

The Juncal-Calavera installation is very similar to the one described above. The turbines are in the same shed, and take their water from the same source. These and the dynamos are also of

the same size and power, but since the distance from Juncal is 7,000 metres, against 8,000 metres for Juncal-Juncalillo, the power available at Calavera for driving the compressors is proportionately less, and only four compressors are driven.

In the Argentine installation the water-power is derived from the Quebrada Navarro, the water being conveyed to the turbines, a distance of 388 yards, by a single line of steel pipes. Owing to the difficulties of travel upon the Argentine side of the mountains, 80 horse-power dynamos were found to be too heavy for transport, and machines of half the power were therefore adopted. At the primary station at Navarro four Girard turbines of 80 horse-power each are used. Each turbine drives two 40 horse-power dynamos directly from its horizontal shaft, one on either side. The machines are in two groups, each of two turbines with four dynamos. One group can be worked independently of the other, should any accident arise, provided it does not affect the source of water supply. The 80 horse-power motors at Las Cuevas are similar to the dynamos at Navarro, and there is about 224 horse-power available for driving the compressors, which are of the same type as those for the Chilian installations. In the three installations, the air is conveyed from the compressors into large steel reservoirs, and from thence to the drills in wrought-iron pipes. The drills are mounted upon carriages, in groups of six, and are run forward on rails to the work.

The several stations are connected by telephone, so that, although the works are widely separated, the same initial power which is, by the various processes, converted into active work at the rock face, affords the means of instant and easy communication with all parts of the works. The workshops are lighted by electricity generated by a separate 10 horse-power dynamo.

THE EXPEDITIONS TO GREENLAND.

ON June 6 the whaling steamer Kite, which has been chartered for the purpose, left this port for Greenland, having on board two parties of explorers bent on adding to our knowledge of Greenland.

One of these parties is under the command of Lieutenant Peary, U.S.N., and is known as the North Greenland Expedition. Of their plans we give an account below. The other is known as the West Greenland Expedition, and consists of Professor A. Heilprin, the geologist, who will command; Professor Holt and Professor Benjamin Sharp, zoölogists; Professor W. E. Hughes, ornithologist; Dr. W. Burk, botanist; Dr. R. N. Keeley and Frazer Ashurst, surgeons; Professor L. W. Mengee, entomologist, and A. C. Kenealy. The West Greenland expedition will, after reaching Whale Sound on the Kite, proceed southward either to Upernavik or Disco Bay and finally to Godhaven, from which point the party will journey in the Kite to Ivigut and thence to St. Johns, Newfoundland. This section of the expedition expects to return about the middle of September.

The plans of the North Greenland Expedition are set forth in a letter from Lieut. Peary to the New York *Sun*, of which we give the following abstract: —

"My party will be landed in June or early in July at Whale Sound, latitude 77° 30′ north. The remainder of this season will be devoted to hunting for the winter's supply of meat, examining the features of the Whale Sound region, collecting natural objects, and more especially to reconnoissances of the inland ice in various directions. It is anticipated that one of these reconnoissances will be carried across the great tongue of the inland ice covering Prudhoe Land to the southern angle of Humboldt Glacier, and an advance depot for the main sledge journey established there. The winter will be occupied in making and fitting sledges, clothing, and all travelling equipment, and in snowshoe and skier practice, for which the level surface of Inglefield Gulf (head of Whale Sound) is especially adapted.

"Early next spring four of five of the party will start over the inland ice to Humboldt Glacier, with full sledges and dogs if practicable. Should favorable advance be made, this party will continue on from Humboldt Glacier to the head of Petermann Fjord. Here a second depot of supplies will be deposited, and from this point the advance party of two or three will push on with full sledges, the others returning to Whale Sound, to devote their time during the absence of the main party to meteorological observations, collecting, and surveying. The main party will proceed from the head of Petermann Fjord to the head of the Sherard Osborne Fjord, establish a depot there, thence to the head of De Long Fjord, establish a depot there, thence to the northern terminus. This point reached and determined, the main party will retrace its steps to Whale Sound, taking up the various depots, and the entire party will then seize the first opportunity to come out.

"The salient features of the project are the smallness of the party and the utilization of the great interior ice plateau, the imperial highway of inner Greenland, as a road, instead of the sea of ice; and the whole theory of the project rests upon the now well-established fact that the interior of south and middle Greenland is covered with an uninterrupted ice cap, and the more than probability (in my opinion) that in north Greenland the conditions are the same, and the ice cap nearly, if not quite, coextensive with the land."

"My personal impression is that the northern terminus of Greenland is not north of the 85th parallel of latitude, and that the inner ice cap is practically co-extensive with the land; and this opinion is shared by Judge Daly and, I think, by most other eminent geographers. But whether this is the case, or whether Greenland extends as an Arctic continent across the pole, or is connected more or less loosely by detached masses of land with Franz Josef Land, or whether the ice cap ends at about the 82d parallel, as in Grinnell Land, I feel confident that in any contingency the efforts of my party will result in discoveries of interest, and, I hope, of considerable value to the scientific world. Should the Greenland ice cap terminate at or south of the 82d parallel, as Gen. Greely believes, I shall endeavor to follow its edge to the unknown east coast above Cape Bismarck.

"The especial advantages of my overland route over all others I regard to be as follows: the possibility of laying a straight course from point to point, with the certainty that no tidal crack or chaos of heaped-up ice will compel a long detour, or stop all further advance; that every foot travelled is a foot advanced, and the comforting assurance that nothing can happen to cut off the retreat; the even and unvarying character of the surface to be traversed, and the gain in lightness of sledges and equipment, and rapidity of advance resulting therefrom; the length of season (at least six months) during which sledging may be prosecuted; the facilities that the 'nunataks,' or island mountain-tops, which project above the 'inland ice' at distances varying from two or three to forty miles from the edge of the ice, offer for forming depots of provisions; and the exceptional value of the elevation of the route in accurately charting the coast and detecting the existence of more northerly land or lands."

"My base is the one advocated by Kane, Hayes, Hall, Judge Daly, and almost every American Arctic authority, — a region having a small and kindly native population, abounding in game, and within easy reach of the whalers which pass Cape York every year on their way to the fishing grounds in Lancaster Sound and adjacent waters. My proposed line of advance is absolutely direct throughout each stage. If it were not desirable to touch at the heads of Petermann, Sherard Osborne, and the other principal fjords which interrupt the northern coast, and determine their length and the characteristics of their heads, the line of march might follow very closely a great-circle course from the head of Whale Sound to beyond Lockwook's 'farthest.'

"As to the dangers and hardships of an eighteen months' sojourn above the 77th parallel, sentiment and imagination aside, I believe them to be no greater than they would be in northern Norway, Siberia, the higher Alps, or, to come nearer home, in Montana or Dakota in winter. It may be news to many to know that there are now in Greenland, under climatic conditions and environments similar to those of my proposed headquarters, Danish officers with their wives and families, living the same home life as the better classes here, with their window gardens, their music, their books, and all the other accessories of culture. I shall endeavor to collect all the scientific material and make all the observations practicable, but my first and last object will be the at-

tainment and determination of the northern terminus of Greenland. and everything will be subservient to that.

"I shall be accompanied by five young men, and the following particulars about the members of the party may be of interest. John M. Verhoeff of Louisville, Ky., is a young man of twenty-five, educated in an Eastern university, a mineralogist, and, though somewhat below the average in stature, has a magnificent lung development and a record for endurance and cross-country walking. Mr. Verhoeff has contributed generously to the expenses of the expedition. Dr. Frederick A. Cook, the surgeon of the expedition, is an able young physician and surgeon, a native of New York State, a graduate of the College of Physicians and Surgeons and of the University of the City of New York, and has been in practice in New York City for several years. He is twenty-six years old, strongly built, is five feet nine inches in height, weighs a hundred and fifty pounds, and has a lung expansion of five inches. Langdon Gibson of Flushing, L.I., is a stalwart young fellow of twenty-six, and one of the many active and enthusiastic members of the American Ornithologists' Union. He was one of the Brown-Stanton party in the memorable Colorado Cañon survey of 1889–90, and knows what arduous work is. He is six feet tall, weighs a hundred and seventy-eight pounds, and has an exceptionally fine lung development. Eivind Astrüp of Christiania, Norway, is a stalwart young fellow, who has but recently come to this country. He is the son of the commander of the Royal Civil Guard of Christiania, a first-class graduate of the Christiana Commercial College, and a winner of numerous prizes in athletic sports, especially ski-running. He is five feet seven inches in height, weighs a hundred and sixty-seven pounds, and has a lung expansion of four inches. Matthew Henson is a hardy young colored man, a native of Virginia, twenty-three years old. His intelligence and faithfulness, combined with more than average pluck and endurance, as shown during several years that he has been with me through varying experiences, part of the time in Nicaraguan jungles, lead me to regard him as a valuable member of the party. The members of my party are all young, and, in addition to possessing first-class physique and perfect health, they are men of education and attainments. I believe this to be the type of man best fitted to endure with minimum effect the ordeal of the Arctic winter, and to effectively execute a two or three months' dash on sledges, where intelligent will-power, elasticity, and enthusiasm are at a premium over the stolid endurance of muscles hardened by years of work. Mrs. Peary will accompany the party to Whale Sound. Possessed of youth, health, energy, and enthusiastic interest in the work, she sees no reason why she cannot endure conditions and environment similar to those in which Danish wives in Greenland pass years of their life. In this opinion I fully concur, and believe that in many ways her presence and assistance will contribute to the valuable results of the expedition, as they have been invaluable to me in the preparation.

"The food supply of the party is not materially different from that of the later Arctic expeditions. Tea, coffee, sugar, and milk are in quantity sufficient to last two and a half years; other supplies for a year and a half. But little meat will be taken, outside of the pemmican for the sledge journey, as there is an abundance of reindeer, ptarmigan, Arctic hares, foxes, ducks, loons, seals, and walrus in and about Whale Sound. Special items of interest, principally for the sledge journey, are as follows: tea, compressed into quarter-pound cakes, partially divided, like chocolate, into quarter-ounce squares; compressed pea soup tablets, a German preparation; beef-meal pemmican and beef-meal and cocoa tablets, prepared expressly for the expedition; evaporated cabbage, potatoes, onions, turnips, carrots, and apples.

"Next to the food supply comes the house. This will be a light structure twelve by twenty feet (inside measurement) with double walls inclosing a ten-inch air space. There will be a triangular air space between the ceiling of the rooms and the roof sheathing, and the rooms will have three layers of tarred paper between them and the exterior air. The walls of the rooms will be hung at first with blankets, and later probably with skins. The house will be surrounded by a wall of stones, turf, and snow as high as the eaves, leaving a narrow passage entirely around the house, and during the winter this space and the roof of the house itself will covered in with a thick layer of snow.

"The expedition will have two whale boats and several sledges, including the two made and used by me in Greenland in 1886. The new ones, though of the same type, will be lighter than the old ones. Each member of the party will have Indian snowshoes and Norwegian "ski" moccasins and rubber ice creepers."

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Immortality in the Light of Modern Dynamics.

I WOULD like, with your permission, to take issue with the writer of the article under the above title published in *Science* of May 29.

The eleventh paragraph, speaking of the reader of the journal of the Institute having "read the same lines" therein, "an endless number of times," "billions of years ago," naturally suggests doubts of his seriousness; and if I am mistaken in the assumption that a gentleman of his great attainments and high position is surely in earnest while thus treating on scientific subjects before that learned body, the Franklin Institute, and that therefore the paper could not have been intended as a burlesque upon modern science, it must be set down to my "simplicity."

In his illustration by the falling of dice, he truly says that the number of dice used has nothing to do with the truth of the proposition that they must, some time, again present — and with a certain average frequency — the same combination of numbers. Evidently, however, he quite overlooks one element of the case, which omission — a most astonishing one — utterly vitiates his illustration and reasoning thereon.

The matter overlooked is the fact that each one of the dice is limited to a certain finite number of exact positions, in one of which it must fall; and after it has, once or more, fallen in each of these, all subsequent falls must necessarily be exact repetitions of some of these, hence the possible number of combinations is also limited, and then must come repetitions.

Let us suppose, however, that the dice, instead of cubes, be perfect spheres, and thrown upon a perfect plane. The number of positions in which any one could come to rest would be infinite, and it is scarcely supposable that it would ever, in an eternity of throws, take absolutely the same position a second time. Now, such is the condition of the atoms spoken of, except that in their case it is more complex, as their are more conditions.

Every particular combination produced must, of course, be simply the resultant of the positions and motions of the atoms. The possible positions and also the possible directions of motion, as well as velocities, are infinite in number, hence the chances are infinity to one against the same combination again occurring even between any two of them, — yea, an infinity of infinities.

Moreover, when the same concurrence of the atoms should occur and reconstruct the same identical form, — of Cæsar, for example, — an essential pre-requisite is, that all influences must be the same as before, hence all surrounding conditions, near or remote, must be identical with those of the former epoch; i.e., the universe must be throughout exactly as before: there are no influences except position and motion, hence every identical atom must be, at the one instant, in the same one of the infinitively various positions, moving at the same one of the infinite different velocities, and in the same one of the infinitely different directions, including the infinite various vibrations, as before, — all this while it is incredible that any one of them will ever move in absolutely the same direction a second time, or that any one of the conditions requisite to the repetition of a former combination will ever exist.

An infinitesimal difference from the former time in the case of any one atom in the universe in any particular at that instant

must affect the next contiguous one, and so on *ad infinitum*, and change the result.

So, taking his illustration of the action of sand grains, not one of them is bound, nor are they likely ever, in an eternity of shaking, to take again the identical position that they have once assumed, because there is not supposed or suggested any cause guiding them to it. There is an infinite number of other positions equally possible and likely,—an infinite number can never be exhausted. And, further, sand grains or atoms have not, like the dice, one fixed plane on which they must rest: the number of planes which they may occupy is unlimited.

In his dice illustration he limited the repetition to the one circumstance of numbers uppermost; whereas, had he taken into account lateral position and distance apart,—all of which, and much more, he must do before he is fully prepared for the rehabilitation of Julius Cæsar in his ancient glory,—his reasoning would not apply, even to the dice.

The former exact position or motion of an atom can have no influence to cause it to be repeated, hence all—conceivable or inconceivable—combinations must be equally possible, equally probable, equally certain; where then is the suggested improbability that the molecules constituting the author's body "once filled a bung-hole," or, indeed, not once only, but an infinite number of times? Some atoms had to fill it, why not those? This point needs elucidation, or we must hold that, according to his "iron logic of modern dynamics,"—which he seems for the moment to have lost sight of,—these very atoms must take their turn at the bung-hole from time to time, as well as the rest.

The great Solomon, the wisest man that ever lived or ever shall live, erred for once in his oft-quoted doctrine, "There is nothing new under the sun," inasmuch as he should have said, "There is nothing *old* under the sun;" i.e., no combination of things, circumstances, or conditions which ever—precisely—occurred before, or which is absolutely identical with those at any preceding epoch. "The thing that hath been is [not exactly] that which shall be."

Hence it plainly appears that the recurrence of the same entire range of conditions, which, to the minutest particular and throughout the universe, is requisite to the reproduction of former structures and actions, is as certain never to take place, as is the same epoch, the identical moment of time, certain never to return.

W. H. PRATT.

Minneapolis, Minn., June 5.

AMONG THE PUBLISHERS.

THE custom of publishing college exercises, which has lately come into vogue, threatens to flood the country with a mass of inferior literature. Several colleges have already adopted the custom; and now Columbia follows their example, with a series of "Studies in History, Economics, and Public Law," which, we are informed, "will be chosen mainly from among the doctors'

dissertations in political science." The opening number of the series is a paper on "The Divorce Problem," by Walter F. Willcox, and is in the main a compilation of statistical matter taken from the report on divorce made by Carroll D. Wright of the Labor Bureau. Various remarks by the author are interspersed, and at the close he considers briefly the causes that have made divorce so common in this country, and offers a few suggestions as to the remedy. Most of his remarks are sensible, but there is nothing new in them, and those who know what has been written on the subject by others will get no particular help from Mr. Willcox. The style of the pamphlet is similar to that of most other college publications, and indicates that the study of literature in the colleges is not what it should be.

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must affect the next contiguous one, and so on *ad infinitum*, and change the result.

So, taking his illustration of the action of sand grains, not one of them is bound, nor are they likely ever, in an eternity of shaking, to take again the identical position that they have once assumed, because there is not supposed or suggested any cause guiding them to it. There is an infinite number of other positions equally possible and likely,—an infinite number can never be exhausted. And, further, sand grains or atoms have not, like the dice, one fixed plane on which they must rest: the number of planes which they may occupy is unlimited.

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SCIENCE

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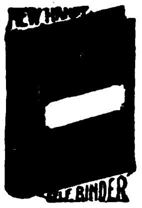

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SCIENCE

NEW YORK, JUNE 19, 1891.

LOCUSTS IN ALGERIA.

IN his last report on Algerian agriculture, Sir Lambert Playfair remarks on the spread of locusts from the eastern part of the province, to which they had hitherto for the most part confined their ravages, to the central regions. Until the eminent entomologist D'Herculais studied the matter carefully, no specific distinction among the locusts was recognized. He has now shown, according to the London *Times*, that there are two distinct species, belonging to separate genera, each of which has very marked peculiarities. These are the best known of the Biblical species, *Acridium peregrinum*, and the *Straurónotus maroccanus*. Their habits are quite different, the former generally arriving suddenly about April or May, in immense flights, and devastating the green crops. The females penetrate deeply into the moist earth, and deposit their eggs, from eighty to ninety in number, inclosed in a cocoon. Two months afterwards the young locusts or crickets are hatched. They grow rapidly, get their wings in forty-five days, and then continue their career of devastation far in advance.

The other species appear in a winged state in July and August. They also ravage what green exists at that season, and the females deposit their eggs at a much less depth than the others, generally on rocky ground. The cocoons do not contain more than thirty or forty eggs, and they remain without being hatched till the spring of the following year. The first species finds in central Africa the most favorable circumstances for its development; the second, in more temperate countries, such as the Mediterranean region, and even the Caucasus, Crimea, and Asia Minor. It is the latter that has ravaged Algeria during the last few years, but about the middle of December last the arrival of flights of the *Acridium* was reported from several of the oases of the extreme south. Fortunately man is not the only enemy of the locust. Starlings and larks feed eagerly on the eggs. Wagon-loads of these birds used constantly to be sent to the French market, but now the killing of them has been prohibited in the province of Constantine. The larvæ of the *Bombyx cantharis* and other insects also get into the cocoons, and often kill from ten to fifty per cent of the eggs, while minute cryptogamic organisms destroy many more.

The best method of contending against the locust has been very carefully studied. Much has been accomplished by ploughing the ground deeply as soon as possible after the eggs have been laid, so as to bring them to the surface, and thus allow them to become an easy prey to birds and insects. The collection and destruction of the cocoons by manual labor is less sure and more costly, but it has the advantage of affording employment to Arabs, who have been reduced to great misery by the destruction of their crops. The statistics of locusts thus destroyed is startling. It has been calculated that between August and December, 1888, the enormous quantity of 8,000 cubic metres of cocoons were collected and destroyed, and that these contained 200,000,000,000 eggs. After the insects were hatched, 1,200,000,000,000 crickets were killed, and it was the excess beyond these figures that invaded the land.

It is now admitted that the most efficacious means of waging war on the locusts is to concentrate all available resources on the destruction of the young. They remain quite stationary during five or six days after being hatched, and thus time is allowed for their destruction. The Arabs employ very primitive means: they jump among them, treading and crushing them under foot, beating about in every direction with branches of broom and oleander, and lighting immense fires all over the place, with alfa grass, or any dry brushwood that may be available. The most practical method is the use of screens similar to those employed in Cyprus. These are bands of cotton stuff, twenty to twenty-five metres in length, on which are sewn strips of American wax-cloth. The young crickets climb up the former, but when they arrive at the latter they can find no foothold, and tumble back into ditches prepared for their reception, along which sheets of zinc are placed to prevent their egress. As soon as the ditches are filled, the insects are covered over with earth and the screens advanced. During last season the material provided in Algeria, but which was altogether insufficient, was 6,000 screens, each 50 metres long; 100,000 oak pickets; 6,000 steel hammers; 450,000 metres of cord; and 60,000 sheets of zinc.

STEAM-JACKET EFFICIENCY.

IN a paper on "Maximum Steam-Jacket Efficiency," contributed to the Journal of the Franklin Institute, Professor Robert H. Thurston says the fact is sufficiently well known that the steam-jacket, as employed on the steam engine, of whatever form and arrangement, is intrinsically a wasteful element, and that its use only gives, in certain cases, an economical advantage by its repression of wastes of larger magnitude. It checks a serious unavoidable waste, more or less completely, by a process which as inevitably involves a waste which is commonly, but, perhaps, not invariably, a lesser one. The ideal steam engine, such as is treated of in the purely thermodynamic study of the steam engine, has a lower efficiency with, than it has without, a jacket. This is readily seen from illustrations computed and checked by Messrs. Hitchcock and Mount, at the suggestion of Professor Thurston, and published in his paper; and it is sufficiently evident, *à priori*, from the consideration that the unjacketed engine receives all its steam at a maximum temperature, expands it adiabatically to a certain terminal temperature, and then exhausts it; while the jacketed receives a part of its heat at intermediate temperatures, expands the fluid non-adiabatically, and finally rejects it at the terminal temperature, with a lower mean range of expansion. In other words, the jacketed engine departs furthest from the principles of economical operations first enunciated by Carnot: "All heat should be received at maximum temperature; expansion should be perfectly adiabatic, and should continue to the minimum temperature and pressure, and all should be rejected as nearly as possible at that minimum." Thus, "theoretically," if the use of that much-abused term may be permitted in this sense, the unjacketed engine is more efficient than the jacketed engine. "Practically," however, the reverse is usually, though probably not always, the case, and the use of the jacket is often found to be productive of a real, and sometimes of large, economy. It is thus obvious that the advantages of the employment of the jacket come of those conditions which distinguish so markedly the real from the ideal case in steam-engine economy; those which make the "theory of the real engine," as the writer has called it, essentially different, in important respects, from the "theory of the ideal engine." In 1886 a "research committee" was appointed by the British Institution of Mechanical Engineers, to investigate the subject of the steam jacket. A very unusually complete set of data, pertaining to trials made with a view to determine the efficiency produced by application of the jacket, was secured. From computations based on these data, performed with great care, the computers checking the figures and the results, there can be no doubt of the existence of a maximum in the value of the steam jacket, the ratios of expansion being varied, and it is probably fairly to be assumed that it may be found in all cases. In the first case, that of the simple non-condensing Corliss engine, the heads unjacketed, the use of the jacket reduced the cylinder wastes from about twenty-five per cent of the ideal consumption of steam and

feed-water to about half that proportion, for ratios of expansion approximating six; from one-third to about one-tenth, at a ratio of five; and apparently from twenty to ten per cent at 4.4. In this first case, also, the jacket gives best results, with 110 pounds of steam, when the ration of expansion approximates six. When the steam pressure falls to approximately eighty pounds, the best work of the jacket occurs at a ratio not far from 4.75; while, at a pressure of fifty pounds, the value of the jacket increases through the whole range of the experiments, and not only so, but the indications are of probable improvement indefinitely in the direction of increasing expansion. The highest efficiencies, however, either with or without the jacket, are found, in this case, at the lowest ratios adopted, and indicate a maximum value at about 3 25. The ratios of expansion for maximum efficiency of fluid, in the other cases, are for 110 pounds, about five, and for eighty pounds, about 3 5. Similarly studying the performance of the condensing engine. we find that the best work is done, whether jacketed or not, at about a ratio of expansion of ten (at a steam pressure of 110 pounds), but that the jacketed engine reduces the internal wastes from fifty per cent at highest ratios, and from one-fourth at the lowest ratios, in the case of the unjacketed engine, to five per cent, and, in some cases, probably to within the magnitude of the errors of observation. At a pressure of ninety pounds the best ratio seems to be for this engine, under the given conditions of operation, about 6.5 when unjacketed, and 8.5 jacketed; while the lower pressures still further reduce both the efficiencies and the savings effected by the jacket. The best work of the jacket, as an economizer of heat, is done at high pressure, at a ratio of expansion of twelve or more. In all cases it seems to be the fact, with these engines at least, that the jacket is useful beyond the ratios of maximum efficiency of fluid. The compound engine exhibits the same general effects which have been noted in the cases of simple engines. This discovery of a maximum efficiency of jacket may throw some light upon the causes of the conflicting and sometimes apparently irreconcilable results of trials of engines with and without jackets, and with jackets variously constructed. The discovery may also prove of value to the designer, as aiding him in securing the best proportions and arrangement of his engine.

THE PREVAILING FEVERS OF CHINA.

DR. COLTMAN, writing in the *Medical Missionary Journal* upon the fevers of China, remarks, says the *Lancet*, that but little personal investigation on the subject has been made up to the present time, owing to the comparatively recent advent of foreign medical men, and to the want of confidence on the part of natives to submit for any lengthened period to the treatment of a foreign physician, or, in fact, to any one physician, their rule being to change doctors two or three times a day if they can afford it. Again, there have been but small hospital facilities for studying fevers, and there is an impossibility of obtaining post-mortem examinations. Dr. Coltman considers that small-pox is the most common disease, nearly every person suffering from it at some period of his or her life. Vaccination, although practiced, is done very carelessly. Measles appear to be common, but are somewhat milder than in Europe. Scarlet-fever, although it undoubtedly occurs among the natives, is far less common than among Europeans. Erysipelas is rare. Typhoid-fever is very difficult to diagnose in the short time that a foreign medical man is allowed to attend a case; but Dr. Coltman thinks that when more accurate reports are possible, this disease will be found to be more common among the natives than is now supposed. Typhus-fever is met with all over North China, and as far south as Shanghai. Relapsing fever is found constantly associated with typhus. Dengue does not seem to be known among natives. Cholera occurs as an epidemic every few years, and is very fatal. Diphtheria is severe, and frequently fatal among the natives. Whooping-cough has occasionally been met with. Rheumatic fever is very prevalent in some parts. Chronic muscular rheumatism is common all over China, but is unattended by fever. Malarial fevers appear to be common everywhere, though the prevailing type varies; thus, tertian is most common in Pekin, quartan in Foochow, Swatow, Shanghai, and Hangchow, and remittent in Cheefoo and Tientsin. In Chinanfu, Dr. Coltman has never seen a case of quartan ague; it is all intermittent of the tertian or quotidian type. The treatment, of course, of all malarial fever is by quinine or some other cinchona bark alkaloid. In Hangchow the carbolic acid and iodine treatment has been used successfully as a prophylactic; arsenic is recognized as valuable in the chronic form.

NOTES AND NEWS.

THE trustees of the University of Pennsylvania have elected Dr. George A. Peirsol, professor of anatomy; Dr. Harrison Allen, professor of comparative anatomy; and Dr. John B. Deaver, assistant professor of applied anatomy.

— Mr. Emil Theilman, a graduate of the Missouri State University, has been appointed to a position as aide on the State Geological Survey.

— Professor Henry S. Munroe is to have charge of the Columbia College School of Mines' summer school of surveying at Litchfield, Conn.

— Professor J. F. Kemp of Cornell University, Ithaca, N.Y., has been appointed adjunct professor of geology at Columbia College, New York.

— The *Engineering and Mining Journal* of this city states that extensive deposits of onyx have been discovered near Marion, Smyth County, Va. Four openings are reported to have been made so far. The stone is said to be of excellent quality.

— The Marine Laboratory of the Johns Hopkins University will be open this summer at Port Antonio on the north-east coast of Jamaica. Professor Brooks and a number of members of his party have already started for the station.

— A writer in *Science Gossip* says that the philosopher Kant one day was passing a certain building in his daily walk, and on looking up, he discovered, as he fancied, that the old birds were actually throwing their young ones out of the nests. It was a season remarkable for the scarcity of insects, and the birds were apparently sacrificing some of their progeny to save the rest.

— The harbor of Salonica, says the *Scottish Geographical Magazine*, is threatened with the same fate as that which has befallen Smyrna. Owing to the alluvial deposits of the Vardar, the harbor is becoming useless as a trading port. The entrance through the sandbanks is very difficult, and the delta of the river has advanced to the neighborhood of Cape Kara-Burun. The prospective value of Salonica to Austria-Hungary may therefore be questioned.

— The recent census of Bengal, says the London *Times* correspondent, in a dispatch of March 27, throws an instructive light on the sanitary condition of the province. The districts showing a decrease in population are mainly those where defective subsoil drainage produces malaria. This is especially marked in parts of Nadiya and Jessor, and is due to the fact that the natural drainage channels have been blocked by injudicious cultivation, and the want of sufficient provision for a water-way in the construction of the railway.

— We learn from the *Scottish Geographical Magazine* that Dr. Konrad Ganzenmüller has published in the *Zeitschrift für wissenschaftliche Geographie* (Bd. viii., Heft 1) a learned and able paper illustrating his hypothesis that the Ukerewe, or Victoria Nyanza, is identical with the Eastern Nile sources of Ptolemy, with the Crocodile Lake of an unknown Greek writer, and with "Kura Kavar" of the Arabs, and that fairly accurate knowledge of the territory of the Nile sources was formerly possessed, but subsequently was lost.

— The collections of fishes made by the "Albatross" in 1887–88, at the Galapagos Islands and in Panama Bay, were reported on by Jordan and Bollmann in the "Proceedings of the United States National Museum," 1889, pp. 149-183. A small portion of the collection, however, failed to reach the authors in time for their report, and has now been listed by Charles H. Gilbert, professor of geology in the University of Indiana. The supplementary list is noteworthy as containing the remarkable new genus *Dialommus*, which repeats in the *Blenniidæ* the peculiar structure of the eyes seen in the Cyprinodont genus *Anableps*.

— European invalids and other persons in search of quiet and a mild climate for winter are beginning to turn their attention to the oases on the northern border of the great Sahara. The climate is said to be very equable. Railway communication through Algeria makes these places less inaccessible than formerly.

— Dr. A. C. Abbott, assistant in bacteriology at the Johns Hopkins Hospital, has resigned his position, to accept the place of assistant director of the Hygienic Institute in Philadelphia. Dr. G. H. F. Nuttall has been elected to fill the vacancy.

— According to the Boston *Medical and Surgical Journal*, Eternod and Haxiers, from the results of their experiments on the transferrence of small-pox from man to the calf, are convinced that small-pox and cow-pox are caused by the same virus. For the purpose of inoculation, small pox lymph from cases varying in severity was used, and was rubbed into a moderately large extent of scarified skin in the abdominal region of the calf. The first inoculation was followed in every case by a scanty crop of postules at the spot chosen. This eruption had at first very little resemblance to typical cow-pox, but on transferring the disease from calf to calf it became more and more characteristic, until, in the opinion of the authors, it was impossible to distinguish it from true cow-pox. The calves vaccinated in this way with human small pox lymph were found in every case to be refractory to vaccination with ordinary cow-pox lymph.

— In early times Asia Minor was celebrated for its fine breeds of sheep and the high quality of its wool, but for many centuries the fat-tailed variety of sheep has replaced all the finer breeds. United States consul Jewett, in a recent report, says that the well-known characteristic of this breed is the enormous tail, which is one mass of fat. These tails will sometimes weigh as much as eighteen pounds each, and give some weight of credibility to Herodotus's story that in Cilicia the sheep had little carts attached to them, that they might the more easily carry their tails. Some shepherds practise cutting off a part of the tails of lambs, severing them at the third or fourth vertebra. This is done in the belief that a large part of a sheep's nourishment goes to the benefit of the tail. It is said, as an evidence of this, that it has been noticed that during times of drought, when pasturage is scant, the sheep's body in general does not comparatively show the effects of lack of food, but that the tail becomes smaller and thinner.

— A large model in relief of Baltimore and its vicinity has been made by Mr. Cosmos Mindeleff of the United States Bureau of Ethnology, for Mr. H. C. Turnbull of Baltimore. Mr. Turnbull has placed the model in the Baltimore Real Estate Exchange. The area embraced extends seventeen and a half miles from north to south, thirteen and a half from east to west, with the city at its centre. This is two hundred and thirty six square miles, including Green Spring Valley on the north, reaching nearly to Sparrows' Point on the east, extending three and a half miles south of the Relay, and considerably west of Catonsville and Pikesville. The scale of the model is four inches to the mile, making its dimensions four feet eight inches by five feet six inches. Its most noticeable feature is the fact that its vertical scale is the same as its horizontal; i.e., all elevations are represented in relief on a scale of four inches to 5,280 feet or one mile. Since the highest point within the area is only 560 feet above tide, all the relief is modeled within less than half an inch.

— The second number for 1891 of the bulletin of the Ohio Agricultural Experiment Station describes three insects which are doing considerable damage to clover and clover hay. The first of these is the clover-root borer. The adult of this insect is a small, brownish black, minutely-spotted beetle, not quite one tenth of an inch long, which deposits its eggs during spring in the crown of the clover plant, four or five eggs being laid on each plant. These hatch, and the larvæ burrow downward through the larger roots of the plant, feeding upon the inner substance, and filling the galleries behind them with their sawdust-like excrement. Late in summer the larvæ become fully grown, when they are one-eighth of an inch long, with a whitish body and yellow head. The injuries of this insect are sometimes very serious, whole fields of clover being destroyed. The remedy is frequent rotation of crops, thus not allowing the clover fields to stand until they become breeding places for the insects. The second insect is the clover-seed midge, a small, orange-colored maggot that develops in the clover-heads at the expense of the seed. It hatches from eggs laid by a very small, two-winged fly, similar to the Hessian fly in appearance. Clover fields infested by this insect are at once distinguished by the unnatural condition of the heads at the time of blossoming. Instead of being red with bloom the heads are green and dwarfed on account of the undeveloped florets. The best preventive of the injuries of this insect yet suggested is that of mowing the field as soon as the presence of the insect is detected, and before any of the seed has reached maturity. The third of these insects is the clover hay worm. Clover hay that has been standing in the mow or stack for some time is liable to become infested by small brown worms, which web the dried stems and leaves together and feed upon them. In one case, to which the attention of the station was called this spring, the lower half of a stack of clover hay was almost totally destroyed by this worm. These worms are more likely to prove troublesome when old hay is left over from season to season for them to breed in; consequently hay-mows should be thoroughly cleaned out each summer, and new stacks should not be put on old foundations until all the leavings of the previous season are removed. Hay which is infested with the worms should be burned.

— Dr. G. H. Williams left Baltimore on May 25, with a party of graduate students of the geological department of the Johns Hopkins University, on a scientific trip in western Maryland. The purpose of the trip is to supplement the work of the recent expedition in southern Maryland. Special attention will be paid to the geological formation of the region.

— The Workingman's School, on West Fifty-fourth Street, New York, was founded in 1878. It was started as a free kindergarten for the children of the poorer classes in the tenement house district. The number of pupils during the first weeks after the opening of the kindergarten was thirty-three. The school has now between three and four hundred pupils, divided into five grammar, three primary, and three kindergarten classes; and it owns a substantial five-story building, containing more than twenty large rooms, a lecture hall, machine shop, etc. Besides the ordinary branches, its course of study embraces manual and art work, a complete course in elementary natural science, gymnastics, music, etc., and a kindergarten normal department has been added to the school proper. The normal kindergarten class will re-open Sept. 14, 1891, and continue till the end of the following June. Applicants for admission must be at least eighteen years of age. The general requisites are, a good English education (high or normal school or their equivalent), ability to sing, and a real interest in and love for little children. The course includes psychology and a study of child-nature, history of education, the principles and methods of Froebel's system, together with practice in the use of the gifts and occupations. Practical work with the children, under the direction of experienced kindergarteners, occupies the mornings; and several afternoons a week are devoted to the theoretical studies. The tuition fee, including all materials, is $65 for the entire course, payable semi-annually. No entrance examination is required, but each student is received on trial for a few weeks, in order that her general fitness for the work may be determined. Regular examinations are held at the end of the course, and certificates given to those who complete it satisfactorily. Further information may be obtained from Miss C. T. Haven, principal of the kindergarten, and, after June 1, from the superintendent of the school, Mr. Maximilian Groszmann, 109 West Fifty-fourth Street, New York.

"A Description of Materials used in Making Commercial Fertilizers," "Fertilizing Materials produced on Farms," and "Fertilizing Composition and Valuation of Various Products," are the titles of articles contained in Bulletin 32 (new series) of the New York Agricultural Experiment Station, of which Peter Collier is director. These fertilizer bulletins are intended to explain such facts as will make farmers familiar with the different terms used to express the composition of fertilizers, and also to enable them to understand some of the more general principles involved in the use of fertilizers, together with such other infor-

mation as it is thought farmers would like to possess. In order that an attempt may be made to cover all points about which information is desired, farmers are urged to send to the station any inquiries in this line in regard to which they desire specific information. This series of bulletins is issued for the benefit of the farmers of New York State. As each bulletin will be a continuation of the preceding one, it will be well for those interested to preserve the early issues for future reference. These and all other bulletins issued by the station will be mailed to any citizen of the State. on application.

— The London correspondent of the New York *Times* writes that the principal biologists and scientists of England, headed by Lubbock, Lister, Lockyer, Playfair, Roscoe and others, to the number of a hunded and fifty, and backed by strong letters from Huxley and Tyndall, recently waited on Sir Michael Hicks-Beach, president of the Board of Works, for a second time, to beg that a license be found for the British Institute of Preventive Medicine, and for a second time met with a refusal. Their eloquent speeches laid stress upon the national disgrace of a situation in which English students of bacterial growths were compelled to go to Paris, Berlin, and Vienna to study their science, and intelligent inquiry and experimental research were forbidden on English soil, as if it were an impious thing to seek for wisdom in the science of saving human life. Sir Michael Hicks-Beach gave an evasive and roundabout reply, which the London *Times* editorially translates as meaning that the anti-vivisectionists have many times more votes in England than all its men of science put together. English laws pay great attention to conserving the rights of rich men to breed hares, rabbits, and game-birds for annual slaughter and maiming by shooting parties, but they sternly punish a man of science who chloroforms one of these rabbits for purposes of experiments having no earthly purpose but to increase knowledge as to saving human life.

— "The last thing that it would be proper for me to do," said Professor Huxley recently, in writing of himself and his aims, "would be to speak of the work of my life, or to say at the end of the day whether I think I have earned my wages or not. Men are said to be partial judges of themselves — young men may be, I doubt if old men are. Life seems terribly foreshortened as they look back, and the mountain they set themselves to climb in youth turns out to be a mere spur of immeasurably higher ranges when, with failing breath, they reach the top. But if I may speak of the objects I have had more or less definitely in view since I began the ascent of my hillock, they are briefly these: To promote the increase of natural knowledge, and to forward the application of scientific methods of investigation to all the problems of life to the best of my ability, in the conviction, which has grown with my growth and strengthened with my strength, that there is no alleviation for the sufferings of mankind except veracity of thought and of action, and the resolute facing of the world as it is when the garment of make-believe by which pious hands have hidden its uglier features is stripped off. It is with this intent that I have subordinated any reasonable, or unreasonable, ambition for scientific fame which I may have permitted myself to entertain, to other ends, — to the popularization of science; to the development and organization of scientific education; to the endless series of battles and skirmishes over evolution; and to untiring opposition to that ecclesiastical spirit, that clericalism, which in England, as everywhere else, and to whatever denomination it may belong, is the deadly enemy of science."

— An interesting discovery has just been made at Rome in the process of excavation for the Tiber embankment. An oblong column, or very thick slab, was uncovered, on which is inscribed the official record of the public games celebrated by Augustus in the year 17 B.C. The decree of the Senate and the regulations enforced by the executive committee are followed by a list of the necessary prayers and sacrifices and the order of the contests. Then comes an announcement that a choir of twenty-seven youths and as many maidens will sing the Carmen Seculare, written by Quintus Horatius Flaccus. In the same locality the workmen have discovered twenty-five additional fragments of the great map of the old city which formerly stood in the Forum of Augustus. When this map was destroyed by fire or earthquake, many of the pieces were thrown into a heap of broken building materials, and finally found their way into the walls of the old Alfieri palace which have just been unearthed.

— The *Kölnische Zeitung* reports that the investigations which the expedition sent out by the Vienna Academy of Sciences has been carrying out in the eastern portion of the Mediterranean have been very successful, and have given important results. In all, the investigations concerning the depth and general characteristics of the sea, and the presence of life in it, were carried out at seventy-two distinct points. The greatest depth (3,700 metres) was found near the great depression which runs between Mola and Cerigo, — a deep valley running in a north and south direction, and with a depth varying from 3,500 to 4,000 metres, the descent being much more abrupt on the Greek side than on the Italian and Sicilian side. Experiments as to light showed that the waters are more transparent near the African coast than in the northern portions. There, white metal plates were discernible at a depth of nearly 144 feet. Sensitive plates were still found capable of being acted upon by light at a depth of nearly 550 yards, at a point 200 nautical miles north of Benghazi: on being drawn up they were found to have been blackened. The acid constituents of the sea-water seem to be the same at the greatest depth as near the surface, nor is any difference in the quantity of ammoniacal constituents perceptible between the upper and the lowest levels, with the exception that everywhere close to the bottom the quantity of ammonia is notable. The deep sea region of the eastern Mediterranean is very poor in animal life. A dredge at a depth of 3,000 metres brought up no animal specimens at all; but at a depth of 2,000 metres leaf-formed algæ were discovered similar to those found at the same depth in the Atlantic by the Plankton expedition.

— The climatic conditions in Corea are imperfectly known; but the *Annalen der Hydrographie* (i., 1891) publishes some valuable meteorological observations (*Scottish Geog. Mag.*, June, 1891) that were made at the Corean ports of Chimulpo, Juensan, and Fusan. The two latter lie on the east coast of Corea, and the former is on the west coast. The chief features of the Corean climate — if one may judge from observations extending over only three years — appear to be the following: Atmospheric pressure at the three stations, mentioned above, is comparatively high from November to February (winter), and low from May to September (summer). Whilst the west coast is somewhat cooler than the east coast, the temperature of the air is rapidly lowered from south to north. The mean annual temperature is much the same as that of places in the same latitude on the east coast of North America. The summer temperatures at the three stations are much the same; but the winters at Chimulpo and Juensan are much colder than at Fusan. At Chimulpo the mercury fell below the freezing-point during the months of October to April; in Juensan, from October to March; in Fusan, from December to May. The mean temperature of the warmest months (July or August) was 26.2° C. in Chimulpo, 26.8° C. in Fusan and Juensan; and of the coldest months (January or February) 5° C. in Fusan, — 4.4° in Chimulpo, and 5.1° C. in Juensan. The prevailing wings are of a monsoon character: on the east coast, easterly; on the west coast, south-westerly. The rainfall decreases from south to north, and is heavier on the east than on the west coast. The rainy season is in summer, the dry season in winter. In Juensan the rainfall was *nil* in January and February of the three observed years. There was no snowfall in Fusan.

— According to the London *Educational Times*, Professor Jean Servais Stas, who recently completed the fiftieth year of membership of the Royal Belgian Academy of Sciences, Literature, and Arts, has been congratulated on that event by the Chemical Society of London in an address which refers to the researches that have placed the name of Stas so high amongst scientific investigators. Among the fundamentally important investigations which have helped to raise chemistry to the dignity of an exact science, are mentioned his "incomparable determinations of the atomic weights of a large number of the more important elements" Not only do the results supply numerical data of the

utmost value, but the "researches are models which must ever serve to show how such determinations should be effected, and the innumerable precautions which must be taken" His refutation of the celebrated hypothesis of Prout, at least in its original form, is noted; as also the services rendered to the chemist by his teaching how to prepare pure re-agents, — the methods devised for the purpose being themselves, in many cases, important contributions to chemical science. The address concludes thus: "Your 'Recherches sur les Rapports reciproques des Poids atomiques' must be handed down to future generations as one of the most valuable classics of the exact sciences. Apart from the intrinsic value of your work, you have, through it, exercised a beneficent influence on your colleagues throughout the world, the importance of which cannot be over estimated, and in the eyes of chemists generally you are ever regarded as an honor to science, to your country, and to the distinguished academy of which you have been an ornament for half a century."

— The monthly report of State Geologist Arthur Winslow of Missouri is at hand. From it we learn that during the month of May examinations of clays and structural materials have been continued in Franklin, Warren, and St. Charles Counties; and the mineral springs of Barry, McDonald, Vernon, Cedar, Henry, Benton, and Camden Counties have been visited, and samples of their waters have been collected for analysis. The examinations of clays and structural materials have further been extended into Ralls, Pike, and Marion Counties. Detailed mapping has been prosecuted in the south-east in Madison County, and west in Ray and Johnson Counties, and about a hundred and ninety square miles have been covered. Examination of coal deposits have been made in Marion County, and samples of coals have been collected for test. In the laboratory, analyses have been made of coals and mineral waters, and the experimental work on clays has continued. Much material has been collected for the report on the pal eontology of the State, and, in this connection, public and private collections in St. Louis, Hannibal, Sedalia, Columbia, Kansas City, and Tabor were visited and studied.

— Lieut. Reed of the United States Artillery stated in a recent paper that photography has been largely used for surveying in Canada under the direction of Mr. E. Deville, the surveyor-general. The Dominion survey made in the ordinary way proved very expensive and slow when the Rocky Mountains were reached, and photography was accordingly resorted to The camera used, as described in *Engineering*, was a carefully made mahogany, brass bound, rectangular box, half-plate size. When in use it was placed on a tripod furnished with levelling screws, and levelled by means of two ordinary tube levels attached at right angles to each other, and which could be placed on that face of the camera which happened to be uppermost. The means for determining the horizon and principal lines were the images of four fine combs, one midway on each side, attached to the camera immediately in front of the plate, the use of small stops making these images clear. The lens used was a Dallmeyer wide angle, No. 1, A. of 5¼ inches focus, affording a horizontal angle of sixty degrees when the plate was disposed with its longer edge horizontal. Six double plate holders were employed. But one adjustment of this camera is required, namely, to insure the verticality of the plate when the tube-levels indicate that the camera is level. The best way to effect this is to substitute for the plate a good plane mirror, face to the rear; then set up a transit in the vicinity. The axis of the telescope being horizontal, observe a distant point intersected by the cross wires, also its image in the mirror: if the latter is also intersected, the mirror is vertical; if not then the tube levels need adjustment. This box camera being rigid, and the focus therefore permanent and suited to distant views and the lines on the faces indicating the field of view, no ground glass or cloth is needed. Care is taken to make the plate-holders exactly alike, a condition which, so far as distance from lens to plate is concerned, is ascertained by measurement Orthochromatic gelatine plates give the best results. Mr Deville considers that a survey made in this way is as accurate as a plan plotted with a very good protractor or made with a plane table. A good deal of attention has been devoted to the subject in France by Dr. Gustave le Bon, who has shown how to obtain all the survey details from a single photograph and one compass observation, provided any one distance contained in the photograph is known.

— The kryokonite collected by Nordenskjöld in Greenland in 1883 has been investigated by Wülfing, and, according to the *Engineering and Mining Journal*, has been found to consist mainly of feldspar, quartz, mica, and hornblende. Garnet, zircon, magnetite, augite, sillimanite, together with a nitrogenous organic substance, are also present in it. The larger part of the dust is thought to be a sediment from the air, and to have been obtained by it from a region of crystalline schists. But the most interesting constituents of the dust, little chrondri of opaque, isotropic, transparent, and double-refractive material, are considered to be of cosmic origin, owing to their similarity to the chrondri obtained in deep-sea soundings. If the amount of dust collected from the snow in Greenland represents the fall in one year, the total amount falling upon the entire surface of the earth in this time is 125,000,000 kilograms, equivalent to a cube of 31 yards on a side.

— Herr P. von Stenin has given a description in *Globus* (Bd. lviii. No. 12) of the Tcheremis, a synopsis of which appears in the *Scottish Geographical Magazine* for June. The details are taken from a monograph written by Professor Smirnoff, of Kazan University, who visited this people in the spring of 1888. The main body now dwells between the Volga and Viatka: they are also found on the Kama, the Bielaja, and its tributaries. Their country falls into two distinct divisions — the "mountain land," stretching from Vassilssursk on the west to Ilyinka on the east, and the "meadow land," much larger in extent, bounded on the west by the Vetluga and its tributaries, the Yuronga and the Usta, on the north by the Viatka, on the east by the Ilet, and on the south by the Volga and the lower Kama. The number of the Tcheremis is given by Smirnoff as 312,591. The mountain land is well clothed with woods of fir and pine, and possesses a very fertile soil; and its inhabitants, who are taller, more powerful, and handsomer than their lowland brethren, follow agricultural pursuits, while the meadow-land Tcheremis, seventy per cent of whose territory is covered with forest, maintain themselves chiefly by the chase. Little in the villages of the Tcheremis is of native origin. Their houses, clothing, dishes, etc., are copied from their Russian or Tartar neighbors. A hut of thin planks, roofed with shingles and used as a summer dwelling, is a peculiarity of the Tcheremis' farm-house, and the women's dress shows some marks of originality. Polygamy still prevails among the pagan Tcheremis. Professor Smirnoff believes that it was not introduced through Mohammedan influence, but is a modification of hetairism, under which system all the women of the tribe were common property. In some districts it is still the practice to carry off a wife by force, and in others the customs observed at the marriage indicate its former existence. The purchase of wives succeeded to rape, owing to Turkish influence, the price being at first regarded as an expiation, as is indicated by the name it bears. The Tcheremis believe in a life after death, and credit the dead with the power of returning to the world. Accordingly, they place food and drink in the coffins, and on certain festivals prepare feasts for their departed relatives. In a child's coffin they place a string, on which is measured the height of the father or mother, at the same time expressing a hope that the child will grow up to be an efficient workman; and they lay bridal garments in the coffin of a girl. From the ranks of the dead are recruited a vast host of evil spirits; e.g., various kinds of fever are caused by the spirits of spinsters. The gods of the Tcheremis are also very numerous. There are the God of Heaven, the God of the Dawn, the Ruler of the World, the Mother of the Bright Sun, and many others. All those deities which stand in close relation to men — such as the gods who give rain, guard the cattle, and protect the fruit and fish — are propitiated with sacrifices. At the present day, however, the Tcheremis offer part only of the victim, the head or heart, and in some districts substitute cakes made in the shape of a horse. The place of sacrifice is usually a grove, and is chosen by a supposed sign from the gods, such as the bursting forth of a new spring. Among the mountain Tcheremis the Greek Church has made considerable progress.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

THE STRUCTURE AND PHYSICAL PROPERTIES OF SOILS.[1]

THERE is no more important economic problem to-day than the production of food and textile fibre to support the life of a rapidly increasing population and to supply their rapidly increasing wants in this age of advancing civilization. Agriculture is the basis of all manufactures, trades, and commerce, and the soil is the basis of all agriculture. This was not generally recognized until Liebig's brilliant generalization of the mineral theory of plant growth, and there was in consequence no material advance in agricultural methods or practices until his time. Since then this mineral theory has been the subject of a vast amount of the most patient research, carried on in the field, laboratory, and plant house. At first it was only considered necessary to determine the chemical composition of a soil and the composition of a given crop to indicate whether the soil had all the elements of plant food in the relative amount contained in the plant, to show whether the soil was well adapted to the crop, or how it could be made so by the addition of chemical substances. Then it was found that all soils have sufficient plant food for ages to come, and that continued cropping during the lifetime of a man would not reduce this amount materially. Then it was claimed, and is still held by many, that only a very small part of the plant food in the soil is in a condition to be readily available to plants, and if this available food is not used up it quickly reverts to a rocky and insoluble form. Then it was endeavored, by the use of solvents of various strengths, to determine how much of this plant food is at any time available to plants; and failing in this, the work has been pushed blindly forward with plat experiments, trying all kinds of mixtures of all kinds of fertilizers, on all kinds of soils, indiscriminately, as one might go into a drug store in the dark and blindly try all the drugs to cure dyspepsia, for it is dyspepsia that affects the plant more often than any thing else,—an inability to appropriate and assimilate the food within reach. We are spending vast sums of money for commercial fertilizers, which are used indiscriminately on all classes of soil, whether they be light and sandy, or stiff with clay.

[1] Abstract of a paper read by Professor Milton Whitney of the Maryland Agricultural Experiment Station before the University Scientific Association, March 25, 1891.

The physical character of the soil has been considered, in all or nearly all the investigations I have ever seen, a vague, complex, but, on the whole, a relatively unimportant factor. The soil is considered a unit. Soils differ physically, just as men differ physically. There is a type of soil suited to grass, another to wheat, others to the different grades of tobacco, and still others to trucks and vegetables. The whole appearance and aspect of the soils differ to the eye and touch.

It is a notorious fact that changing seasons of wet or dry, or hot or cold, have far more effect on the crops than any combination of manures. This in itself is a significant fact.

In ten years a soil may be so worn out as to become a barren waste. This is not from any loss of plant food, for the amount so removed from the soil is relatively so small that it cannot be detected with any certainty. But the fact confronts us, that the wheat and corn lands of the great North-west are deteriorating, and the wheat and tobacco lands of our own State are deteriorating, both as to quality and quantity of product.

I come now to the main point of this paper, that the exhaustion of soils is physical rather than chemical; that vegetation, under given climatic conditions, is dependent upon the circulation or movement of water in the soil, and that it is possible to change the physical conditions of the soil so as to control this water circulation, and so control the growth and development of the plant. Nay, further, that the chief benefit derived from the use of commercial fertilizers and manures is their physical effect on the soil, which modifies the relation of the soil to water, rather than, as heretofore supposed, to the actual amount of food they supply the plant. The soil is to be considered as a vast irrigating pump which provides standing room for the plant and supplies it constantly with nutritive fluids. If too much water is supplied the plant is inclined to develop leaf in large excess; if too little water is supplied the growth is stunted, but it puts on relatively more fruit. It is a mean between them that is desired for all plants, but a different mean for each class of plants.

The soil is composed of minute fragments of rocks and minerals, with varying quantities of organic matter. Even the poorest and most barren soils are shown by chemical analysis to have sufficient plant food for countless generations of plant life, while in ten years or less a soil may be "worn out," and made for a time a barren waste.

However compact and continuous and close textured a soil or sub-soil looks, there is still about fifty per cent by volume of empty space between the solid particles. That is, a cubic foot of soil will hold half a cubic foot of water, if all the space is filled. Clay soils have more empty space than sandy soils. We have found on the average about forty-five per cent by volume of empty space in sandy soils and fifty-five per cent in clay lands. The amount of empty space in the soil may readily be calculated by dividing the weight of soil by the specific gravity, which gives the actual volume of the soil grains, and subtracting this from the total volume occu-

pied by the soil. The light sandy sands, therefore, are light only in texture, for a cubic foot of sand weighs about one hundred and ten pounds, while an equal volume of clay weighs seventy-five pounds.

The water of the soil has to move in this empty space, and the relative rate of movement will depend upon how many particles there are in the soil, for this will determine the number and size of the spaces between the particles in which the water will have to move.

The soil particles vary in size from about 2 millimetres in diameter to about .0001 of a millimetre, which is near the limit of microscopic vision. The coarser particles are called sand, while the very finest particles are known as "clay." We cannot emphasize this point too strongly, that clay differs from sand only in the size of the grains. The particles of clay are hard and compact as sand, are composed largely of quartz, and they have themselves none of the inherent stickiness associated with clay in mass.

The plasticity of moist clay and the hardness of dry clay in mass, as distinguished from the looseness and incoherency of sand, is due to the fact that the clay has a vastly greater number of particles in a unit mass than sand has, and as each grain touches the surface of six or eight adjacent grains, there are many more points of contact for surface attraction to act and bind the mass of clay together.

The approximate number and size of the particles may be found or calculated from the mechanical analysis of a soil. The mechanical analysis consists in separating the particles into eight or ten or more grades whose diameters range between rather narrow limits by sifting and subsidence in water.

The mechanical analysis in its simplest form, as devised by Nöbel and adopted some years ago by the Society of Agricultural Chemists of Germany, consists in boiling the soil for some time in water, to disintegrate any lumps, and placing it in the first of a series of conical-shaped vessels having a capacity respectively of 1, 8, 27, 64. A stream of water is let in which carries the finer particles over into the next succeeding larger vessel, where, the motion of the water being slower, grains of somewhat smaller size may settle, and so on. Many small grains are, however, carried down with the large ones, and Hilgard has improved on this by having a paddle revolving at a high speeed in a porcelain cup, which keeps the soil thoroughly agitated. From here the mixture rises into a wide tube sufficiently high so that large grains thrown up by the current of the paddle will not go over. When the water comes over clear the receiving vessel is changed, and the velocity of the water is increased so as to carry over grains of a larger size. Johnson and Osborn have simplified this in the following method. The soil is gently rubbed up in a mortar with a rubber pestle with repeated quantities of water, until the water, after standing a moment over the soil in the mortar, is perfectly clear and all grains smaller than .05 of a millimetre have been removed, as shown by microscopic measurements. The coarser grains are then sifted in a series of sieves.

The turbid liquid is allowed to stand until all particles, larger than a certain size, have settled, as shown by microscopic measurements on a drop of the liquid removed with a rod or tube. The turbid liquid is poured off into another beaker to settle, and the contents of the first beaker is stirred up with a fresh quantity of water, and the settling continued until all particles, smaller than a certain size, are removed, and so on for the several grades. The separations are finally dried and weighed.

The following table gives the mechanical analysis of two markedly different types of soil: —

Diameter in Millimetres.		Truck Soil.	Limestone Subsoil.	Approximate Number of particles in 1 gram.	
				Truck Soil.	Limestone Subsoil.
2 to 1	Fine Gravel.	1.41	0.00	3	0
1 " .5	Coarse Sand.	8.19	0.00	142	0
.5 " .25	Medium Sand.	43.78	0.18	6,094	26
.25 " .1	Fine Sand.	24.04	0.26	32,930	371
.1 " .05	Very fine Sand.	5.81	2.39	101,000	43,350
.05 " .01	Silt.	8 61	27.60	2,341,000	7,825,000
.01 " .005	Fine Silt.	1.98	10.74	34,430,000	195,000,000
.005 " 0	Clay.	4.48	53.02	1,952,000,000	24,450,000,000
		98.23	94.19	1,988,911,169	24,652,868,747

From the results of the mechanical analysis, the approximate number of particles in the soil can be calculated from this formula: —

$$\frac{a}{\frac{\pi (d)^3\, 2.65}{6}} \div \text{total weight of soil.}$$

Where a is the weight of each group of particles, d the mean diameter of the particle in the groups, and 2.65 taken as the specific gravity of the soil.

From this and the weight of a unit volume of soil, the number of particles on a unit area of surface can be calculated.

$$\left(\sqrt{\text{No. particles in 1 cc.}}\right)^{\frac{2}{3}}$$

There will evidently be one space or opening into the soil for every surface grain. If the grains have a symmetrical arrangement the mean size of these spaces can be calculated from the formula: —

$$r = \sqrt{\frac{V}{\pi \, N \, L}}$$

Where r is the radius of the space, V the total volume of all the space, N the number of spaces on a unit area, and L the depth of soil.

The circulation of water through the soil will depend upon the size of these spaces, and not in any simple ratio either, but according to the fourth power of the radius multiplied by the number of spaces. You will bear in mind we are not trying to establish absolute but relative values.

Here are ten tubes, each with a radius of three units, and here is one single tube with a radius of ten units, having the same capacity and area of cross section of the ten tubes. If they were exceedingly small capillary tubes water would flow through the single large tube about twelve times faster than through the ten tubes. So it is in the soil. If we assume that there is the same amount of empty space in a clay soil as in a sandy soil, there are at least ten times the number of spaces in the clay soil for the water to move through, and the movement is very much slower than in a sandy soil. Clay has no inherent property of absorbing and holding moisture not possessed by sand, as popularly supposed, the difference being due entirely to the number of particles per unit mass.

SCIENCE

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SCIENCE

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ANTHROPOLOGICAL INVESTIGATIONS IN SCHOOLS.[1]

PHYSICAL anthropology has for its object the study of the human body and of its functions. It deals more particularly with the variation of form and function caused by varying conditions or founded on inherited peculiarities. This object is attained by dividing the human species into classes, which are treated separately. Such classes or groups may be founded on difference of race; they may be founded on difference of social status; they may be founded on difference of geographical surroundings or of age. The peculiarities of each group and their differences are brought to light by a statistical treatment of the individuals comprised in each class, and the causes of these differences are studied by comparing the various groups.

The differences between these groups are not confined to the adult age, but develop during the period of childhood and adolescence. Therefore the study of the latter forms a most important branch of anthropology. It appears that the differences between the classes are comparatively slight in the beginning, but develop during the period of growth, so that the adults of the various groups show much greater divergences than the children of the same groups. These differences in the adult stage may be brought about by earlier arrest of development in certain groups than in others, or by development in diverging directions. Differences of form are generally accompanied by differences of function.

From these general considerations we must conclude that a study of the anthropology of children is of the greatest importance for a knowledge of the conditions and laws of growth. It appears probable that the mode of growth of a city population and of a country population will be found different, as the adult forms show certain differences. The American child grows differently from the European child, for there exist differences between the adult American and the adult European. The child in New England grows differently from the child in Kentucky, as the adult forms of the two countries are not the same. We may also assume that the child growing up under favorable sanitary conditions will develop differently from the less fortunately situated child. Even where the adult forms are identical we may find differences during certain stages of development which may shed an important light upon questions referring to growth.

The problems which are touched upon here have a great importance to the teacher, because the functions of any organ and also of the whole body are closely related to its development and form. The nature of this correlation is by no means clear, but remains largely a matter of investigation. Nevertheless, its existence cannot be doubted. One of the most striking cases of this kind is the result obtained by Axel Key in his extended investigations in Sweden. He found that the liability to sickness decreases with increasing rate of growth and increases with decreasing rate of growth, so that the one may be taken as the measure of the other. We know from other sources that skill in the use of certain parts of the body cannot be attained after growth has been completed, but that it must be attained during the period of development, so that the special nature of practice has an influence upon the function and probably also upon the form of the organs in the adult individuals. Piano players and rope dancers may be mentioned as instances of this kind.

The various parts of the body do not develop at the same time. Therefore we must suppose that each has its peculiar time during which it is best adapted to being trained. For these reasons the teacher has an immediate interest in the prosecution and in the results of investigations upon the bodily development of school children.

Most researches on growth have been made from purely anthropological points of view, the relation of the investigations to school work having been brought out only lately. Quetelet's investigations in Belgium were among the first that were founded on extensive material. The subject did not receive, however, great attention, until Dr. H. P Bowditch made his classic study of the school children of Boston and vicinity. His measurements included height standing, and weight. Simultaneously Dr. Charles Roberts carried on similar investigations in England. In his work are found a considerable number of data referring to the development of the various parts of the body, some of which have been taken from Quetelet's tables. Dr. Bowditch's measurements were repeated in Milwaukee by George W. Peckham, who showed that certain important differences in the rates of growth prevail in that city and in Boston. Series of observations of less extent were made by Pagliani in Turin in 1879, by Kotelmann in Hamburg in 1877, by Daffner in the military schools of Bavaria in 1884.

Michailoff carried on an investigation on a closely allied subject in Moscow, where he studied the development of the chest, a question which was also included in Dr. Roberts's measurements. An interesting article on this work has been written by Erismann. Another investigation carried on in Kretcy, Russia, by I. A. Müller, has not been accessible to us.

Lately the superintendent of schools of Freiburg in Saxony had a series of measurements made, in order to determine the proper height of seats for scholars of various classes. The most important work of this kind, and one which claims particular attention of educationists, because it has been undertaken on a large scale and solely in the interest of schools, is the inquiry of the Royal Swedish Commission, whose work was edited by Axel Key.

All these investigations were based on statistical material, that is, on the treatment of a long series of observations, but no effort was made to follow the same individuals through a series of years. Although Vierordt claims that the former method will give just as good results as the latter, provided the number of observations is sufficiently large, it must be borne in mind that the latter method, the individual method, will give many results which the general method cannot give, and that it is the only method that will allow the education-

[1] Dr. Franz Boas in the Pedagogical Seminary for June.

ist to apply the results of the general method to practical cases. Libarzik in Vienna measured twenty children regularly from the day of their birth to their eighth year, and two hundred boys from their eighth until their fourteenth year. The first to make an investigation of this kind with special reference to school work was Dr. Wretlind, who measured the increases of children during vacations and during the term. In Denmark Dr. Vahl made semi-annual weighings of the girls at Jägerspris. He arrived at the conclusion that weighings of this kind are the only means of controlling satisfactorily the sanitary conditions of school children. The studies of R. Malling-Hansen indicate that the development depends upon climatic conditions, in so far as the winter seems to cause a retarding influence. If this is true, schools in northern countries ought to have longer summer vacations than schools in southern countries, in order to make up for the lesser growth during the cold season. An important investigation of this character has also been made in Germany by Dr. Landsberger, in Posen, who followed the growth of one hundred and four children through a period of five years.

Most of these investigations deal with the growth of the whole body; they refer only incidentally to the growth of certain parts of the body. Valuable material on this point is, however, contained in Dr. Landsberger's investigation. He found, for instance, that during school age the diameters of the head change only very slightly, while the growth of the body as a whole is very rapid. The next step to be taken in researches of this kind will be the study of the growth of individual parts of the body in connection with their functions. The growth of the hand, together with its increase in strength, ought, for instance, to be studied. The remarkable changes in the curvature of the skull, the relative development of face and head, in short, the development of each part of the body, ought to be made the subject of most searching and careful inquiry. The results to be obtained from investigations of this kind will undoubtedly teach us how to develop the faculties of children each at its proper time.

ISOLATION OF A CHOLERA TOXINE.

HERMANN SCHOLL (*Berlin. klin. Woch.*, Oct. 13, 1890) communicates an interesting paper giving the results of some experiments with a poisonous body isolated from cultivations of the cholera bacillus. According to the *British Medical Journal*, he thinks it curious that in all previous investigations on the nature of the cholera, toxine cultivations should have been used which had been grown in the presence of air; whereas, in his opinion, in order to imitate the conditions under which the cholera bacillus grows in the human intestine, the most essential point is that the culture be grown in the absence of air. In this assumption he follows Hueppe and Cartwright Wood, who, he considers, have satisfactorily shown that the cholera bacilli grow in the small intestine in the absence of oxygen, and that their extreme virulence or rapidity of poison production depends chiefly on this anaerobic growth. Other observers, among whom Petri may be cited, think that this point requires more rigorous proof than has yet been afforded.

To obtain this anaerobic growth, the author used the method introduced by Hueppe of growing the bacilli in raw eggs, by which means he holds that oxygen is completely excluded. The inoculated eggs were kept for eighteen days at a temperature of 36° C. When opened the contents were found to give off a very powerful smell of sulphuretted hydrogen, differing in this from cultures grown in air. He describes the white of the egg at this period as being fluid and watery, the yolk firmer in consistence and black in color. In order to test the toxicity of the egg contents, five cubic centimetres of the fluid part were injected into the peritoneal cavity of a guinea-pig. The animal at first showed signs of paralysis, then convulsive movements, and died at the end of forty minutes. This proved that the fluid egg albumen was very poisonous.

The author then proceeds to describe his method of isolating the poison. Briefly, it is as follows. The fluid part of the egg contents, which amounted to 150 cubic centimetres, was dropped into ten times its volume of absolute alcohol. The white precipitate thrown down was collected and digested with 200 cubic centimetres of water at 40° C. The effect of this was to dissolve only a very small quantity of the precipitate, which was then removed by filtration. Eight cubic centimetres of the transparent filtrate were then injected into the peritoneal cavity of a guinea pig, and caused death in one minute and a half. This fluid entirely lost its poisonous properties on being boiled in the steam sterilizer for half an hour, while a short heating to 75° C. had no such effect. On the other hand, when placed at 40° C. *in vacuo*, over chloride of lime, the fluid was found next day to be completely inert.

The author then subjected the poison to the usual chemical tests, and came to the conclusion that it was no ptomaine, but a peptone, differing, however, from the toxo-peptone isolated by Petri from aerobically grown cultivations. This peptone could be obtained in a solid form by dropping the watery solution into eight to ten times its volume of a mixture of the ether and alcohol, rendered faintly acid by acetic acid. The resulting precipitate was found to be insoluble in pure water, but soluble on the addition of an alkali. After repeating this precipitation and resolution several times, pure ether was substituted for the mixture of ether and alcohol, and the peptone obtained after evaporation as a white bulky substance. A very small quantity of this dissolved in water was then injected into the peritoneal cavity of a guinea-pig. The animal at once became totally paralyzed. After half an hour convulsive movements of the head and extremities set in, and at the end of five hours the guinea-pig died. The author concludes, as the result of his experiments, (1) that the poisonous peptone, elaborated by the cholera bacilli under conditions of anaerobiosis from the albumen of the egg, is different from the toxo-peptone of Petri, since the latter was not decomposed on boiling, while the former was; (2) that this cholera pepto-toxine is much more poisonous than the toxines found by Brieger and Petri in cultures grown under aerobic conditions, since the poison obtainable from a single egg was capable of killing ten guinea-pigs in the space of ten minutes; (3) that these experiments are in favor of the contention of Hueppe and Wood that the cholera bacilli, when grown anaerobically, form a greater quantity of, and a more powerful, poison than when grown aerobically.

NOTES AND NEWS.

THE *Pedagogical Seminary* says that in Darmstadt and other large German cities pot-plants are given to school children who live in tenements. They are usually three in number and of the same size, with printed directions how to care for them. At the end of a year are exhibitions and prizes.

— At a meeting of the Royal Society, London, on June 4, the following gentlemen were duly elected fellows of the society: William Anderson, Professor Frederick Orpen Bower, Sir John Conroy, Professor Daniel John Cunningham, Dr. George M. Dawson, Edwin Bailey Elliott, Professor Percy Faraday Frankland, Percy C. Gilchrist, Dr. William Dobinson Halliburton, Oliver Heaviside, John Edward Marr, Ludwig Mond, William Napier Shaw, Professor Silvanus P. Thompson, and Captain Thomas Henry Tizard.

— According to the *Engineering and Mining Journal*, Professor Salisbury of the United States Geological Survey has made arrangements with Professor Smock, in charge of the Geological Survey of New Jersey, to undertake geological studies of the formation of the surface in sections of New Jersey, with especial reference to the glacial drift. He will begin work next month, and his study will be confined to Middlesex, Union, and Essex Counties during the summer. Monmouth and Mercer Counties may also be visited.

— A press dispatch from San Francisco says that the Czar of Russia has presented the Stanford University with a complete collection of Russian and Siberian minerals taken from the St. Petersburg Museum. The collection is valued at about $35,000, and comprises some eight hundred specimens. Mrs. Stanford will, in return, it is stated, send the Czar a collection of California minerals and precious stones.

— The object of the Society of American Friends of Russian Freedom, recently organized by well-known Americans, is to aid by all moral and legal means the Russian patriots in their efforts to obtain for their country political freedom and self-government. Those who wish to join this society and receive also *Free Russia* (published monthly), should send their names and post-office addresses, with the membership fee of one dollar, to Francis J. Garrison, treasurer, 4 Park Street, Boston, Mass.

— A meeting of the Baltimore Branch of the Archæological Institute of America was held on April 26. Major J. W. Powell of the United States Geological Survey spoke of the Zuñi Indians. Officers were elected as follows: president, Daniel C. Gilman; vice-presidents, Mendes Cohen, Basil L. Gildersleeve, William W. Spence, and Arthur L. Frothingham, Jun; treasurer, Henry F. Thompson; secretary, J. Le Roy White; delegates to the council, David L. Bartlett and Arthur L. Frothingham, Jun.

— According to the *Pedagogical Seminary*, in Russia, Servia, Roumania, and Bulgaria over 80 per cent of the population are illiterate, Spain 63 per cent, Italy 48 per cent, Hungary 43 per cent, Austria 39 per cent, Ireland 21 per cent, France and Belgium 15 per cent, Holland 10 per cent, United States (whites) 8 per cent, Scotland 7 per cent, Switzerland 2.5 per cent, some parts of Germany 1 per cent. In Sweden, Denmark, Bavaria, Wurtemberg, and Saxony only rarely a person cannot write.

— Esquirol called attention to the fact that idiots without the power of speech could sing. Dr. Wildermuth of Stettin compared 180 idiotic children with 80 normal children in regard to vocal range, sense of harmony, and memory for melody; and 27 per cent of the idiots and 60 per cent of the normal children were classed as musical in the highest degree, 11 per cent of the idiots and 2 per cent of the normal children were without musical ability. This remarkable relative development of the musical sense in idiots, says the *Pedagogical Seminary*, is the more striking as there is no evidence of any other artistic taste. The practical outcome of Wildermuth's observations is to emphasize the necessity of vocal culture in the training of idiots.

— The Society of Arts, London, offers a gold medal or £20 for the best invention having for its object the prevention or extinction of fires in theatres or other places of public amusement. In cases where the invention is in actual use, reference should be made to places where it could be inspected. A full description of the invention, accompanied by such drawings or models as are necessary for its elucidation, must be sent in on or before Dec. 31, 1891, to the secretary of the Society of Arts, John Street, Adelphi, London.

— Those interested in questions relating to physical education will find much to please them in a paper, in the June number of *Physique*, by the Rev. T. A. Preston. Many boys are not much attracted by games, and it seems hard that in such cases any sort of compulsion should be used. Why not have various alternative ways of securing exercise, any one of which might be chosen? Mr. Preston shows with great force, says *Nature*, and in a very interesting manner, with how much advantage the study of natural history might in some instances be substituted for cricket and football. Boys out for a field excursion take a great deal more exercise, he maintains, than is ever taken at cricket. "With those who are keen naturalists," he says, "the mere exercise taken in any one day (not in an excursion) is often such that it might almost be said to require moderating. I have no hesitation in saying that, if exercise alone is to be considered, a field naturalist will take far more than any one at games."

— A series of experiments with regard to evaporation from free water surfaces and from earth saturated with water, in sun and in shade, has been recently made by Signor Battelli. *Nature* states (quoting from *Il Nuovo Cimento*) that he used three large tubs or vats, two holding water, and the third earth on a grating, to which water was admitted from a pipe entering the bottom. One water-tub and the earth-tub stood a few yards apart on the north side of a high wall; the other water-tub was in the open, and embedded in the ground. Signor Battelli's results are these: The quantity of water evaporated from moist earth is in general greater than that from a free stagnant water surface, when the air temperature rises; but less, when the latter falls. With increasing wind-velocity, evaporation increases more rapidly from the water surface. The moister the air, the greater (other things equal) seems to be the ratio of the water evaporated from the moist earth to that from the stagnant water surface. The evaporation of a water surface exposed to the sun's rays is greater than that of a shaded one, not only by day, but in the following night. With rising temperature, the ratio between the water quantities from these two surfaces increases somewhat more quickly; with rising wind-velocity, this ratio diminishes.

— Dr. S. V. Clevenger, in the *Alienist and Neurologist* for July, 1890, describes an infant prodigy, Oscar Moore. Two little colored children were reciting the multiplication table at their home, in a little cabin in Texas, as they had repeatedly done before, and one of them asserted that four times twelve was fifty eight, whereupon a thirteen months old baby, Oscar Moore, who had never spoken before, corrected the error by exclaiming, "Four times twelve are forty-eight!" There was consternation in that humble home until the family became reconciled to the freak. Oscar was born in Waco, Texas, in 1885; his father is an emancipated slave, his mother is a mulatto. He was born blind; the other senses are unusually acute; his memory is the most remarkable peculiarity. He is intelligent and manifests great inquisitiveness: his memory is not parrot-like. When less than two years of age he would recite all he heard his sister read while conning her lessons. He sings and counts in different languages, has mastered an appalling array of statistics, and is greatly attracted by music. The writer concludes that Oscar is not mentally defective, but may possess extraordinary mental powers.

— A direct observation of hail in the process of formation is recorded in the *Naturwissenshaftliche Rundschau* and noted in a recent number of *Nature*. In the afternoon of a squally day Professor Tosetti, looking eastwards through the window of a house (in northern Italy) which, with two others, inclosed a court, saw the rain which streamed down from the roof to the right, caught by a very cold wind from the north, and driven back and up in thick drops. Suddenly a south wind blew, and the drops, tossed about in all directions, were transformed into ice balls. When the south wind ceased, this transformation also ceased, but whenever the south wind recurred, the phenomenon was reproduced, and this was observed three or four times in ten minutes.

— So much has been said and written upon the smoke-abatement question in England that the idea of utilizing this dire enemy of public health and cleanliness so as to actually make its existence a source of profit is somewhat attractive. In a lecture recently delivered by Professor V. B. Lewes, reference was made to certain facts in this connection, of high interest. As given in *Invention*, one of these facts was that at three or four Scotch ironworks the Furnace Gas Company are paying a yearly rental for the right of collecting the smoke and gases from the blast-furnaces. These are passed through several miles of wrought-iron tubing, diminishing in size from six feet down to eighteen inches, and as the gases cool there is deposited a considerable yield of oil. At Messrs. Dixons' at Glasgow, which is the smallest of these installations, they pump and collect about 60,000,000 cubic feet of furnace-gas per day, and recover on an average 25,000 gallons of furnace oil per week, using the residual gases, consisting chiefly of carbon monoxide, as fuel for distilling and other purposes, while a considerable yield of sulphate of ammonia is also obtained. In the same way a small percentage of the coke-ovens are fitted with condensing gear, and produce a considerable yield of oil, for which, however, in its crude state, there is but a limited market, the chief use being for lucigen and other lamps of the same description, and for treating timber for railway sleepers. In view of such arrange-

ments Professor Lewes is not unnaturally sanguine that the smoke-fiend may eventually be dealt with in a way quite as satisfactory, but far more profitable than mere self-consumption. The oil above described can, for instance, be greatly improved in quality by ridding it of the large percentage of watery particles it contains when freshly condensed. Mr. Havely of Baghill, England, has devised a process whereby not only the water, but the paraffine, cresol, and phenol, are removed from the crude oil, leaving the residuum in better condition, and of high value for timber. This oil, Professor Lewes asserts, can be used as an enricher of gas, enabling gas of a higher illuminating power to be produced at a reduced cost. If this be true it will not be the least remarkable instance of waste-products of a process becoming even more valuable than the original article manufactured.

— A correspondent of *Indian Engineering* says he recently witnessed a very interesting mode of obtaining a foundation for a new building. A hole was bored in the ground (which was previously damp), from ten to twelve feet deep and an inch and a half wide, and a string of cartridges was lowered into it. The subsequent explosion not only produced a cavity a yard in diameter, but also drove the water out of the surrounding earth by means of the expansive action of the gases. The water did not return to its former place for fully an hour, so that an opportunity was afforded to fill up the cavity with quickly settling concrete, and a rapid rate of working was thus attained.

— In his recent lecture on fire prevention Professor Goodman states, says the *Builder*, that, generally speaking, wooden joists are better for buildings than steel or iron joists. The two latter materials, he explained, lose their strength at a not very high temperature, whereas wood would sustain a heavy strain for a much longer period when exposed to great heat. Besides, when wood has once been charred, it does not burn so readily again. Iron and steel soon expand under the influence of heat. Brick and stone are objectionable: the former become fused under great heat, and the latter is liable to crack or fly when suddenly cooled after heating. The drawback to tiles is, that, when fire plays upon the joists of floors fitted with them, the joists expand and allow the fire to play upon the joists through the tiles. Portland cement is objectionable, as it flakes off when heated, but if wire netting or bars are embedded in concrete this defect is remedied. A joist padded with silicate of cotton and incased in salamander plaster (a mixture of silicate, cotton, and plaster-of-Paris), the professor holds, is a splendid fireproofing material. Such a material is not only a non-conductor, but it is elastic, and would yield with the joist. In an experiment undertaken by Professor Goodman it was found that a joist of this kind withstood very fierce heat for eight to nine hours without sustaining any serious damage.

— Dr. J. Hann has communicated another important treatise to the Vienna Academy, entitled "Studies on the Conditions of Air-Pressure and Temperature on the Summit of the Sonnblick," with remarks upon their importance for the theory of cyclones and anticyclones. The work is based upon four years' observations, and is divided into eight sections, which are given in *Nature* of June 4 as follows. (1) An investigation of the general meteorological conditions under which the maxima and minima of air-pressure occur on the Sonnblick. The anomalies of pressure are more marked above than below, and are increased by the accompanying temperature anomaly, which is relatively high in barometric maxima, and relatively low in barometric minima. (2) The range of temperature during the passage of a barometric wave. This is, at least during the winter season, the opposite to that at the lower level. (3) Temperature with varying amount of cloud in winter. The highest temperature coincides with the least cloud, upon the summit, and conversely on the plain. The clear winter days on the Sonnblick have relatively high temperature with great dryness, and these conditions are characteristic of the barometric maxima. (4) Monthly maxima and minima of temperature. The former mostly occur during barometric maxima, and the latter when the high pressure lies in the west or north, and while a barometric minimum exists over Italy or the Adriatic. (5) Temperature and air-pressure on the Sonnblick during barometric minima over central Europe, especially over the eastern Alps. The mean temperature at the height of 6,650 feet during the passage of barometric minima was below the normal, amounting on an average to 2.5° F. during the winter season. The use of deviations of pressure and temperature in answering many questions of atmospheric physics is here discussed. (6) Vertical distribution of temperature, and mean temperature in a column of air of three kilometres in height. The calculations have been made separately for each winter. (7) Preliminary indications respecting the relations of the wind-directions to barometric maxima and minima. A considerable divergence (45° to 90°) is shown from the directions as observed below, and the results confirm the conclusions drawn from cloud observations by J. A. Broun and others. (8) Refutation of some objections against the conclusiveness of temperature observations on mountain summits, and general remarks on cyclones and anticyclones. The author points out that recent mountain temperature observations and other facts are opposed to the explanation of barometric maxima and minima in extra-tropical regions by purely thermic considerations.

— According to *Engineering*, Messrs. David Moseley & Sons, of Manchester, are introducing a form of battery zinc in which the element is built up of a number of tubes constructed of thin sheets, which can be obtained in great purity. These tubes are slipped inside each other to form the element. Each tube is amalgamated before the element is put together, and the mercury permeates the whole wall of the tube, as the latter is only one-thirty-second of an inch thick, and the zinc is very pure. The amalgamation is accordingly very perfect, and local action is entirely got rid of. The manufacturers state that when these elements are used, no time has to be spent in cleaning and scraping the zincs, which remain free from chloride of zinc and crystals till completely expended.

— Considering the question of determination of the evaporating power of a climate, Dr. Ule distinguishes (*Met. Zeits.*) between the intensity and the speed of evaporation. The latter, says *Nature*, can be well determined with an instrument like Wild's evaporimeter; and Dr. Ule sets forth, in a table, the monthly data of this for Chemnitz, compared with those of absolute humidity, "saturation deficit," and relative humidity. The agreement of the last with the evaporimeter figures is much better than that of the two others; still, there is considerable discrepancy, and this is not explained (the author shows) by variations in wind-intensity. On the other hand, the data of the psychrometer show a remarkable parallelism with those of the evaporimeter, and by taking wind-variations into account the agreement is increased. Thus, from psychrometer-differences and wind-variations, the evaporative power of a climate may be correctly estimated where an evaporimeter is wanting. Dr. Ule offers a new formula for estimating the layer of water evaporated in a given time, and tests it with two German climates and one Australian.

— The government of the Dutch East India colonies has instituted a prize competition open to the world. The Dutch government is a large producer of salt on the island of Madura, and it is anxious to find a practical way of packing the salt, as it is retailed for government account. To the contestant who offers the best and most economical method the Dutch government offers to pay $4,000. The government salt comes from the numerous open salt ponds in the island named. After the product from these ponds has been partly dried by solar heat it is brought to the government store-houses, where it remains for a year or longer. The product is light gray, of irregular crystals, and likely, if exposed to climatic influences, to absorb moisture and melt. For this reason the Dutch colonial government wants the salt packed in such a way that the weather cannot affect it, a desideratum which it has yet failed to obtain. The material used in packing must be proof against the action of the salt and at the same time must not injure the salt in any way. It must also be strong enough to preserve the salt for at least two years, and after the cans or boxes are closed the salt must not melt. The cans or boxes must hold just a kilogram of salt each, to be packed in larger cases for transportation. It is estimated that for the total yearly production 74,150,000 cans or boxes of one kilogram each will be needed. The packing

operation will, if required, have to be preceded by an artificial drying process, as it has been found that salt carefully dried is more easily preserved. A detailed statement of costs must be filed, and for wages the average paid in the Netherlands must be figured upon. A special contest will take place at Amsterdam between the competitors. For this the contestants must supply the necessary materials and machinery. The government will buy from the contestant receiving the premium the machinery used by him at the contest. Answers must be filed with the Department of the Colonies at the Hague before Sept. 1.

— A butter extractor (or extractor separator), a new machine for making butter directly from fresh milk, is now being run regularly at the Pennsylvania Agricultural Experiment Station, on Mondays, Wednesdays, and Saturdays of each week. Any persons desiring to see the operation of the machine will be welcomed and given every facility for investigating its workings. Visitors from a distance should purchase railroad tickets to Lemont. A stage connects with all trains.

— Medical studies of the school children in Berlin showed that 25 per cent had more or less defective hearing, most of them being thought deaf enough to be incommoded in their work. The *Pedagogical Seminary* remarks that such partially deaf children are often thought unjustly by their teacher to be inattentive. More effort of attention is needed by such children, who are usually utterly incredulous concerning their defect, although they often complain that the teacher speaks too low or indistinctly. Children from better homes are less often defective than those from squalid ones.

— Beginning on Wednesday, July 1, and continuing six weeks, there will be held at Plymouth, Mass., a school for the discussion of practical ethics in the broadest sense of that phrase. The matter to be presented has been selected with regard to the wants of clergymen, teachers, journalists, philanthropists, and others, who are now seeking careful information upon the great themes of ethical sociology. The course of lectures will cover three different departments: economics, history of religions, and ethics proper. The department of economics will be in charge of Professor H. C. Adams of the University of Michigan. Professor Adams will deliver seventeen lectures, three during each of the six weeks, on the history of industrial society and economic doctrine in England and America, beginning with the middle ages, and tracing genetically the gradual rise of those conditions in the labor world which cause so much anxiety and discussion to-day. His associates and the topics which they will treat are as follows: Professor John B. Clark of Smith College, "Modern Agrarianism;" Albert Shaw, American editor of the *Review of Reviews*, "Social Questions suggested by the Crowding of Cities;" Professor Edmund J. James, president of the American Society for the Extension of University Teaching, "Education in its Social and Economic Aspects;" Henry D. Lloyd of Chicago, "Trusts;" Professor Frank W. Taussig of Harvard University, "Co-Operation;" Hon. Carroll D. Wright, United States Commissioner of Labor, "Factory Legislation;" President E. Benj. Andrews of Brown University, "Socialism." The department of the history of religions will be in charge of Professor Crawford H. Toy of Harvard University. Professor Toy will offer a general course of eighteen lectures, extending through the six weeks, treating the history, aims, and method of the science of history of religions, and illustrating its principles by studies in the laws of religious progress, with examples drawn from the chief ancient religions. His associates and their topics are Professor M. Bloomfield of Johns Hopkins University, "Buddhism;" Professor George F. Moore of Andover Theological Seminary, "Islam;" Professor Morris Jastrow, Jun., of the University of Pennsylvania, "The Babylonian-Assyrian Religion;" Professor G. L. Kittredge of Harvard University, "The Scandinavian Religion;" Professor B. I. Wheeler of Cornell University, "The Greek Religion;" Mr. W. W. Newell, editor of the *Journal of American Folk-Lore*, "The Religion of the Laity in the Middle Ages." The department of ethics will be in charge of Professor Felix Adler of New York City. Professor Adler will offer a general course of eighteen lectures, extending through the six weeks, on the system of applied ethics, with special reference to the moral instruction of children, including a brief survey of the various schemes of classification adopted in ancient and modern ethical systems, the discussion of the relation of religious to moral instruction, of the development of the conscience in the child, etc. His associates and their topics are Dr. Charlton T. Lewis of New York, "Criminals and the State;" Professor J. B. Thayer of Harvard Law School, and Hon. Herbert Welsh of Philadelphia, "The Indian Question;" Mr. J. H. Finley, secretary of the State Charities Aid Association of New York, "The Problem of Charity in Great Cities;" Rev. C. R. Eliot of Boston, "Temperance Reform and Legislation;" Emil G. Hirsch of Chicago, "The Ethical Ideal in Education;" Professor Wm. E. Sheldon of Boston, "Humane Treatment of Animals;" Mrs. Caroline Earle White, president of the Woman's Branch of the Pennsylvania Society for the Prevention of Cruelty to Animals, "Vivisection;" Mr. W. L. Sheldon of St. Louis, "Reform Movements among Workingmen;" Mr. Wm. M. Salter of Chicago, "Ethical Theory;" Professor Robert Ellis Thompson of the University of Pennsylvania, "Politics and Ethics."

— In the course of an investigation, part of which has already been communicated to the Royal Society, Professor Roberts-Austen has discovered the most brilliantly colored alloy as yet known. *Nature* states that it has a rich purple color, and bright ruby tints are obtained when light is reflected from one surface of the alloy to another. It contains about 78 per cent of gold, the rest of the alloy being aluminum. The constants of the aluminum-gold series of alloys are now being examined, and will shortly be published.

— According to *Nature*, the relations of weather and disease have been recently investigated by Herr Magelssen of Leipzig, who, having formerly called attention to the nature of certain "waves" which recur in the variations of temperature (distinguishing waves of about 12 days, 50 days, and 18 to 20 years duration), now traces a connection of these with diseases and mortality. The year-waves especially show this connection, the mortality (in our latitudes) varying with the winter temperature. The least mortality (relatively) is at the middle part of the temperature periods. The injurious influence of heat is dominant in the more southern latitudes (such as Vienna), while cold begins to act beneficially. In northern places, mild winters prove injurious where several very mild winters come in succession (e.g., Stockhelm in 1871–74). The most favorable conditions seem to be an alternation of moderately cold and moderately mild winters. Too much importance, the author thinks, has been attached to relative humidity. He further offers proof that infectious disease is even more dependent on weather than disease of the respiratory organs, or arising from chill.

— The value of systematic observation of snow is now being recognized in meteorology, says *Nature*, and in Russia observations were commenced in January last year at 428 stations in the European portion of the empire, 21 in the Asiatic, and 55 in the Caucasus. At first it was simply reported daily whether there was a continuous snow-covering about the station or not. But last winter the inquiry had been extended to the depth and general behavior of the snow. Thus it is expected that in a few years some valuable climatological material will have been accumulated at St. Petersburg. The report of Herr Berg on the snow in the early months of 1890, in European Russia (*Repert. für Meteor.*), contains a map showing the southern and western limit of the continuous snow-covering for the first and fifteenth of each of the months from January to April. In the west the snow extended steadily till the beginning of March, the limit being then close to the Baltic. In the south-east, there was steady advance till February, and as far as the coast of the Caspian. In the south, the advance was fluctuating, there being a maximum in the middle of January and in the middle of February, both reaching to the Black Sea coast. The retirement of the snow-limit began in the south and south-east in the middle of February; in the west about half a month later. The general direction was north-east. On April 15 the limit passed through Onega on the White Sea, Wetluga, and Katherinenburg. By the first of May all European Russia was free from snow. Herr Berg describes the weather accompanying the disappearance of the snow, and traces its causation.

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Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

THE CHEMICAL LABORATORY OF THE CASE SCHOOL.

THE "First Annual Report of the Chemical Laboratory of Case School of Applied Science," Cleveland, Ohio, which is under the directorship of Professor C. F. Mabery, contains a brief review of its development since the school was opened in 1881. The liberal expenditure at first granted by the trustees for chemical supplies, and for equipment of the temporary laboratory, laid the foundation for immediate arrangement of the course of study, which became necessary to meet the demand for instruction in chemistry. Upon the removal of the school to the new building on Euclid Avenue, in September, 1885, the commodious, well-lighted rooms on the third story were assigned to chemistry, and they were occupied until the building was burned in October, 1886. In promptly providing for the continuance of instruction after the fire, in a separate building, the trustees made it possible to resume laboratory work with a delay of less than four months. This building has served an excellent purpose during the four years it has been occupied, and the great amount of labor that has been expended in developing the course of study will be apparent when they are expanded in the more spacious rooms of the new laboratory. The first graduates in chemistry were of the class of 1886, and fifteen now fill responsible positions as chemists and professors of chemistry. Two of the graduates have received the degree of doctor of philosophy from the University at Berlin, and two others have nearly completed an advanced course of study, one at the University at Heidelberg, Germany, and the other at Zurich, Switzerland.

For the best development of chemical training, the beneficial influence of original research or study of special problems upon students as well as instructors, is recognized; and while it may be possible to include very little of this work in a course of study for undergraduates, the general effect of such an atmosphere is stimulating to their ambition. Then, too, questions constantly arise in professional pursuits that can only be determined by the application of knowledge independent of routine methods. The investigations carried on were on subjects of considerable practical importance. An exhaustive study by Mr. A. W. Smith of the composition of the water of the lake at different points along the shore, and the influence of varying currents in causing contamination, indicated the direction that an extension of the inlet tunnel should take to provide the best supply for the city. A paper on salt brines led to the perfection by Dr. Dow of a process now in operation for the extraction of bromine from brines that promises to replace the older methods. Although many methods have been proposed and protected by patents for the removal of sulphur from Ohio petroleums, the results of investigations made at Case School gave the first information concerning the forms of the sulphur compounds in these oils. The examination of oils from other localities promises interesting results. Since 1884 investigations have been constantly in progress in the laboratory on the metallurgy and uses of metallic alluminum and its alloys, and they have contributed to the great reduction in price of the metal and to its more general use in the arts.

THE AMERICAN SOCIETY OF MICROSCOPISTS.

THIS association, now in the thirteenth year of its existence, will hold its fourteenth annual meeting in Washington, D.C., beginning Aug. 10, and continuing in session five days. Its roll of active members contains about three hundred and fifty names, embracing nearly every person in the United States who is at all prominent as a microscopist. Its membership consists of two distinct classes; viz., professional men and students of the natural sciences, who use the microscope in their daily avocations as an instrument of research, diagnosis, or precision; and amateurs, or those who find pleasure and profit in the revelations of the instrument. Many of the latter class, from having early chosen special lines of study and investigation, have acquired high reputations in their respective departments of microscopical research. In its earlier years this class predominated in the membership of the society, but at present the professional element is largely in excess.

The qualifications for membership are very simple. The applicant must be a respectable person socially, and interested in the use of the microscope.

The advantages of membership are dual in their nature; i.e., general and social, or those which accrue to the individual from association with others engaged or interested in the same pursuits in any and all walks of life; and special, in that the meetings of the society are to a certain extent educational in their nature. In the "working sessions" experts in every department of microscopical technology are engaged in giving manual demonstrations of the details of their lines of work; in the informal evening *conversaziones* the room of every worker who has anything special to exhibit or demonstrate is open for the reception of all those who wish to witness the demonstration; finally, the *soirée* affords an opportunity of displaying for the benefit of the members, as well as the public generally, all that is most beautiful, interesting, and instructive in the cabinets or laboratories of the exhibitors. Of late years the *soirées* have been attended by many thousands of visitors in every city in which the society has met, and have been regarded as distinguished social as well as scientific events.

The dues are only two dollars per annum, and in return the member gets a volume of the "Annual Proceedings," which costs very nearly this amount. All persons, professional or amateur, interested in microscopy and not already on the rolls, are invited to send in their applications for membership to the secretary, Dr. W. H. Seaman, 1424 Eleventh Street, Washington, D.C. The application should be accompanied by three dollars, which is the initiation fee and one year's dues. Any further information concerning the society or the approaching meeting may be obtained by addressing Frank L. James, president, Box 568, St. Louis, Mo.; W. H. Seaman, secretary, 1424 Eleventh Street, Washington, D.C.; or C. C. Mellor, treasurer, 77 Fifth Avenue, Pittsburgh, Penn.

INTERNATIONAL CONGRESS OF GEOLOGISTS.

THE Committee of Organization of the International Congress of Geologists announces the following details with regard to the meetings of the Fifth Geological Congress, to be held in Washington from Aug. 26 to Sept. 2, and for excursions which will follow.

The meetings will be held in the rooms of the Columbian University, at the corner of Fifteenth and H Streets. A large lecture-room, and smaller rooms for meetings of the council, exhibition of maps, rocks, minerals, etc., have been set apart for this purpose. Special postal, telegraph, and messenger service will be arranged in the building during the week of the meeting, and a bureau of information, where members will register. Those who arrive before the opening of the congress are requested to register their names at the secretary's office, 1330 F Street.

The meetings of the American Association for the Advancement of Science, and of the Geological Society of America, which will take place during the week preceding that of the meeting of the congress, will be held in the same building. The daily programme of the several meetings is as follows.

Aug. 19 to 22. — Meetings of the various sections of the American Association for the Advancement of Science. The foreign members of the congress have been made honorary associate members of the association by its council, and are thereby entitled to take part in its geological and archæological excursions in the vicinity of Washington, and to avail themselves of the reduced rates of fare on railroads which are accorded to its members. American members of the congress who are not already members of the association are invited to join it at the present meeting.

Aug. 24 and 25. — Meetings of the Geological Society of America. The foreign members of the congress are likewise invited to attend the meetings of this society, to contribute papers, and to take part in the present meeting.

Aug. 26 to Sept. 2. — Meetings of the International Congress of Geologists.

Besides the regular subjects of discussion, such as unfinished business of the former congress, reports of committees, etc., the Committee on Organization recommends that the following subjects be made special topics for the consideration of the congress at this meeting: (I) Time correlation of the clastic rocks; (1) correlation by structural data; (*a*) by stratigraphical data, (*b*) by lithological data, (*c*) by physiographical data; (2) correlation by paleontological data; (*a*) by fossil plants, (*b*) by fossil animals; or (*a*) by marine fossils, (*b*) by terrestrial fossils: (II) General geological color schemes and other graphic conventions: (III) Genetic classification of the pleistocene rocks.

The Committee of Organization has arranged with Thomas Cook & Son for reduced rates on certain lines of ocean steamships, for members coming from Europe. On all the principal railroads of the United States, members can obtain a reduction of one-third on regular rates from all main points to Washington and return, if they are members of the American Association for the Advancement of Science, or become so during the meeting. For this purpose it is only necessary in buying a ticket for Washington to obtain from the agent a receipt for the amount paid, on a particular form furnished him for this purpose. When the member leaves Washington, the presentation of this receipt, together with the membership card of the association, will entitle him to a return ticket over the same route for one-third the regular fare.

The long excursion will be made on special trains, carrying seventy-five persons, and fitted with all the latest appliances for the comfort of travellers. It will constitute a moving hotel, permitting free and safe passage from one end to the other at all times, and will take the party wherever the rails are laid in the regions visited, and stop wherever desired. As at present planned the excursion will occupy twenty-five days, and cost $265 per person, which will cover every necessary expense. The route laid out covers thirty-eight degrees of latitute and twelve of longitude, and enables the traveler to see the finest scenery and most important geological phenomena of the Eastern States, the Mississippi Valley, and of the Rocky Mountain region, passing a week among the wonders of the Yellowstone Park.

The following shorter excursions are suggested, and American geologists familiar with the regions stand ready to conduct parties. If a sufficient number agree to go on these excursions, concessions may be obtained from the railroads to reduce the expenses to a minimum: (1) Through the Southern Appalachian regions, examining the peculiarly appressed folds in paleozoic rocks, and viewing the newly opened mines of coal, iron, manganese, tin, and gold; (2) to the copper and iron regions of Lake Superior, and the great developments of Pre-Cambrian or Algolkian rocks; (3) through the coal and oil regions of Pennsylvania to Niagara Falls, down the St. Lawrence River to Montreal and Quebec, and return through the classic paleozoic and taconic regions of New York and Vermont.

Members who desire to examine particular localities or geological horizons are requested to correspond with the secretaries as early as possible, and all efforts will be made to arrange so that their wishes may be complied with. Already a short excursion has been planned by Professor H. S. Williams for the week preceding the meeting of the geologists to see the typical development of paleozoic beds (especially Devonian) in the State of New York, in which a number of European geologists have already signified their desire to participate. Correspondence should be addressed to S. F. Emmons, 1330 F Street, Washington, D.C.

BACTERIA.

THE first of a series of lectures on the nature and functions of bacteria was recently delivered at the Royal Institution, London, by Dr. E. Klein, F.R.S. According to the *Lancet*, to which we are indebted for a brief report of the lecture, Dr. Klein said that perhaps in no branch of biological science had advances in the methods of research within the last twenty-five or thirty years been so enormous as in this subject. In 1828 Ehrenberg recognized the existence in water of minute mobile organisms, which he considered to belong to the group of animalculæ known as infusoria, an assumption which was now known to be erroneous. In 1837 Schwann demonstrated the presence in atmospheric air and in dust of living microscopic beings, which he showed by direct experiment to be endowed with the power of producing in certain fluids those chemical changes termed alcoholic fermentation or putrefaction.

Pasteur fully established the proposition that the different fermentations, such as alcoholic, butyric, acetous, mucous, and lactous fermentations, and also the decomposition of putrescible matter, were caused by definite and different species of such minute living beings, microbes, and that without them such changes did not occur. This proposition implied that these changes were dependent on and ultimately bound up with the life and growth of these microbes, and if these were prevented from gaining access to such fermentative matters, they would remain unchanged or sterile. This was the principle which Sir Joseph Lister had applied in surgery, with the well-known brilliant results. The *rôle* of these microbes in atmospheric air had been minutely worked out and beautifully illustrated by Professor Tyndall, who shared in finally establishing that with these simple organisms, belonging almost to the world of the infinitely small, the same fundamental principle obtains as in other living organisms of plant and animal life, be they ever so large and complex, namely, that each organism had descended from an antecedent parent organism, and that no such thing as their origin from nonliving matter occurred.

Within comparatively recent times it has been shown that a variety of the most important and extensive processes of oxidation and reduction which occur in nature, — such as the oxidation and resolution of dead animal and vegetable matter, the breaking up of complex nitrogenous materials and their ultimate change into nitrites and nitrates, and the specific fermentation so important in foodstuffs and articles of diet, and many other processes, — are caused by and intimately connected with the growth and life of microbes. Though the importance of some species as useful agencies in nature is recognized, the importance of other species, as being the cause of disease affecting plants, animals, and man, is not less. The term micro-parasite is given to this latter group.

Amongst the microbes there is one great group to be dealt with in particular, called "bacteria," because it possesses more or less the shape of a minute rod. Like the true or higher fungi, they are free from chlorophyll, and are composed of cells, a cellular membrane with living matter or protoplasm within, and they multiply by fission, for which reason they are called "fission fungi." Bacteria can then be defined as microscopic elementary organisms, composed of a cellulose investment of the protoplasmic contents, and which multiply by simple fission. They are classified into micrococci or cocci, bacilli, and spiral vibriones, according to whether they are spherical, cylindrical, or curved and spiral.

All these organisms, when they have found suitable nidus, multiply with enormous rapidity. It has, for example, been found from observation — all conditions of moisture, medium, and

temperature being favorable — that some multiply in twenty minutes, others in thirty minutes, and others in forty minutes.

Staphylococcus aureus, which in its growth produces a peculiar golden-colored filament, grows with great rapidity when sown in a medium like faintly alkaline broth at a temperature of 37° C. Into a sterile broth tube a definite number of organisms are put, say eight cocci per cubic centimetre. If placed in an incubator for twenty-four hours at 37° C., and then counted, it is found that 1 cubic centimetre contains 640,000; that is to say, one organism has multiplied eighty thousand-fold in the first twenty-four hours. It would not be expected that the same rate would obtain in the second twenty-four hours, because the material had been used up. After forty-eight hours' growth the counting yielded 248,000,000 per cubic centimetre; that is, only four hundred-fold. In seventy-two hours it was found that there were 1,184,000,000 per cubic centimetre; that is to say, during the last day each had multiplied only five-fold. As the material is used up the rate of multiplication decreases.

Another instance of the rapidity of growth was given. A rabbit was inoculated subcutaneously with 20,000 bacilli of fowl cholera, and died in twenty-four hours. It was found that 15,150,000 microbes were contained in one cubic centimetre of the blood of the animal. The whole of the blood contained twelve hundred millions, showing that each bacillus in twenty-four hours had multiplied sixty thousand times. Those organisms which have their habitat in ordinary temperatures grow very rapidly. Professor Ferdinand Cohn was the first to study the rate of multiplication on the hay bacillus. He calculated that in two days the number of these would be so great that the whole Atlantic Ocean would be densely peopled by them if there was sufficient nutriment, which, fortunately, there is not, and therefore many of them had to go to the wall.

By the motility of bacteria is understood active locomotion. They spin round, they dart to and fro, and pass rapidly over the field of the microscope, and that is on account of their possessing one, two, three, or even a multitude of fine hairs. The organism of typhoid fever possesses several of these *flapellæ*. It has been shown that for retaining this motility a plentiful supply of oxygen is required. If, in a chamber, at one end oxygen is supplied, and at the other nitrogen or hydrogen gas, the organisms will all move towards the end where the oxygen is. If the oxygen is replaced by nitrogen or hydrogen the movement gradually ceases. If water is covered with a scum, it is most probably a motile bacillus which grows in the fluid, and is driven to the surface, where it can derive the best supply of oxygen. In many cases the motility of the organisms is interfered with by their own chemical products.

Within certain of these organisms, but not in all, are formed peculiar corpuscles, which bear the same relation to the organisms as the seed does to the plant. This spore formation is almost entirely limited to the order of bacilli, and in this group there are very many species which do not possess this power. In a number of different species of bacilli, some of which are capable of forming spores and others not, those which have this power may look on very quietly, while those that do not will exhaust all the nutritive material present, growth and multiplication will then cease, and they will gradually die away. Those which form spores have a much better chance of bringing forth new generations than the others.

When organisms do not find suitable materials for their growth, certain changes are brought about called "involution changes." When the bacillus ceases to possess that high degree of vitality that the normal typical bacillus possesses, it gradually undergoes changes which lead to its death. Illustrations were given of what had been described as involution changes, but which were not so. For instance, tubercle bacilli grown under not very favorable conditions may be swollen, and others may appear branched. Some observers took these changes to indicate the death of the organism, but the lecturer was not quite sure that such were "involution changes."

In all these considerations, particularly in reference to the formation of spores, there were a number of facts of very considerable practical importance. The germination of those organisms which form spores takes place on the same principles as the germination of the spores in the higher fungi. The envelope is broken, the protoplasm contained within it shoots out in the shape of a rod, which when it is fully formed elongates, divides, and multiplies, as in the case of the parent. In this way one bacillus, by repeated multiplication, forms a new crop. When these have reached a certain phase of development they again form spores, which go to start a new generation. These spores have a much greater power of resistance than is possessed by the non-spore-bearing organisms, and can withstand high temperature, dryness, and the influence of light, so much so that it has become almost a recognized method of determining whether a particular species of bacilli forms spores, by subjecting the suspected organism to a temperature of 95° C. or 100° C. If they survive this exposure, and if they survive drying, it may be taken as established that the growth is spore-forming.

HEALTH MATTERS.

The Transmissibility of Hydrophobia from Man to Man.

THE fact that no instance is on record of hydrophobia having been transmitted from man to man has given rise to a doubt as to whether the saliva of human beings suffering from the disease possesses the same virulent properties as that of the dog similarly affected. In not more than five or six of the ten thousand patients treated at the Pasteur Institute was the lesion due to bites inflicted by human beings, and it is evident that statistics bearing on so small a number of cases are of no value one way or the other. It has, however, been proved experimentally, says the *Medical Press*, that the saliva of human beings having succumbed to hydrophobia produces the disease in animals by inoculation, though the incubation period is somewhat prolonged. It may, therefore, be taken as proved that the disease may be transmitted in this way from man to man. It is hardly possible as yet to affirm categorically the possibility of curing hydrophobia after the characteristic symptoms have made their appearance, but recent observations throw a doubt on the incurability of the disease even under these circumstances.

LETTERS TO THE EDITOR.

⁂ Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

The Glacial Grooves on Kelley's Island to be Preserved.

THE world of science will rejoice that at last the most remarkable of the glacial grooves on Kelley's Island is to be preserved as an object-lesson to future generations forever.

Many of the citizens of Cleveland will remember that when, in 1888, the American Association for the Advancement of Science met in their city, an excursion was made to Put-in-Bay on the steamer "City of Cleveland," and that, on the way, the boat stopped at the dock of the Kelley's Island Lime and Transport Company, on the north-east corner of the island, to give the men of science an opportunity to see what there was left of the wonderful glacial grooves that have made that locality famous the world over. A few minutes after the palatial steamer touched the dock at the lime-kilns, the hundreds of expectant excursionists might have been seen swarming around and over the great natural wonder they had come to see, and inspecting it from every point of view. They had come, they had seen, and they were conquered. The expressions of astonishment and delight from the eminent scientific men in the company (among whom were numbered Professors Alexander and N. H. Winchell, Professor Cook of New Jersey, Professor Morse of Boston, Major Powell of Washington, Professor Spencer of Canada), as well as from the great number of intelligent amateurs and others present, were of the most extravagant character; and ardent desire was expressed on every hand that measures might be taken for the preservation of the renowned glacial phenomenon, concerning which all felt that the half had

not been told them. But, alas, the interests of a great business corporation seemed to demand the destruction of the last remnant of these most celebrated works of the glacial age. Many were the regrets expressed at the near prospect of the accomplishment of this real calamity to the interests of scientific education.

But so it was not to be. Mr. M C. Younglove, the president of the company, then gave his word that the groove which had excited their admiration should be preserved. For three years the workmen have sacredly spared the spot. Gunpowder and dynamite have been kept from injuring these most wonderful exhibitions of nature's most wonderful geologic work, until we are permitted to record that to-day it has been placed beyond danger. At Mr. Younglove's invitation, Rev. Dr. Sprecher and myself have carefully surveyed the premises with him, and, on presentation of the case to the company at its annual meeting on the island to-day, the following resolution was unanimously passed: —

"Resolved, that, in the name of this corporation, the secretary and treasurer be and are hereby authorized to deed to Mr. M. C. Younglove a piece of the groove at the south-east corner of the north quarry at Kelley's Island, said deed to convey a strip of land fifty feet wide and one hundred feet long; said strip of land to be deeded by him to some scientific or historical society, to be preserved in perpetuity for the benefit of science."

This was adopted by unanimous vote of the stockholders.

The grooves thus preserved are probably the most remarkable in the world. They occur in the hard limestone of the vicinity, where the ice movement from the north-east encountered the projecting rock, and spent its main force upon it. As the ice pushed up and over the obstruction, a mingled mass of mud, sand, gravel, and bowlders was shoved along beneath it. Under this force the bowlders became ploughshares; the gravel and sand, rasps and files; and the frozen mud, a pumice-stone to furrow and score and polish the whole. Originally a large area of this glaciated surface was exposed to sight. But in the progress of work upon the extensive quarry, the larger part of it has been removed. What is left, however, is ample for an object lesson. The portion of the groove preserved is thirty-three feet across, and the depth of the cut in the rock is seventeen feet below the line extending from rim to rim. Originally there was probably here a small depression formed by pre-glacial water erosion, into which the ice crowded the material which became its graving tool; and so the rasping and polishing went on in increasing degree, until this enormous furrow is the result. The groove, however, is by no means simple, but presents a series of corrugations merging into each other by beautiful curves. When exposed for a considerable time it will resemble nothing else so much as a collection of prostrate Corinthian columns, lying side by side on a concave surface.

These grooves have long attracted the attention of the collectors of geological curiosities. Those persons in Cleveland who are interested to see specimens of this remarkable phenomenon can gratify their desire by noticing the collection of stones on the Public Square, just opposite the First Presbyterian Church. This was placed there by the Western Reserve Historical Society, and contains one of the first millstones used in the country. But beside it is a notable fragment of one of the glacial grooves from Kelley's Island. Mr. Younglove also has a still more remarkable specimen in front of his residence at 614 Euclid Avenue. Specimens of these grooves have also been procured for the Harvard College Museum, and a specially large and fine one was sent a year ago by Mr. Younglove to Oberlin, and adorns the college park in front of the library.

Col. Whittlesey paid much attention to the study of the grooves on Kelley's Island as they were in progress of being uncovered, and secured many fine specimens for the collection of the Historical Society, which can be seen in their rooms. The society also has a large number of original drawings of the grooves, executed by Col. Whittlesey, and accompanied by much unpublished descriptive matter. Neither has attention to those remarkable exhibitions of glacial action been confined to this country. In my recent work on the "Ice Age in North America," I have taken pains to introduce several photographs from this place. In a recent issue the London *Athenæum* (March 28, 1891) fairly went into ecstacies over them, exclaiming, "How paltry appear the furrows ploughed by ice on our glaciated rocks beside the monstrous groovings eroded on the Sandusky Islands in the western part of Lake Erie, and figured from photographs, at pp. 232–242 of this book."

The direction of these grooves is a little south of west, corresponding to that of the axis of the lake. This is nearly at right angles to the course of the ice scratches on the summit of the water-shed south of this, between the lake and the Ohio River. The reason for this change of direction can readily be seen by a little attention to the physical geography. The high lands to the south of the lake rise about seven hundred feet above it. When the ice period was at its climax, and overran these high lands, it took its natural course at right angles to the terminal moraine, and flowed south-east, according to the direction indicated by the scratches on the summit. But when the supply of ice was not sufficient to overrun the high lands, the obstruction in front turned the course, and the resultant was a motion towards Toledo and the Maumee Valley, where, in the vicinity of Fort Wayne, an extensive terminal moraine was formed. The grooves on the islands near Sandusky were produced during that stage in the recession of the great ice-sheet.

The groove preserved is only a small portion of what still exists, but it would be too much to ask to have more given by the company. As it is, the public spirit shown by the directors, gathered from Boston to Duluth, has rarely been equalled by a similar corporation. Quarrying has already proceeded nearly all around this specimen, and soon the monument preserved will be a monument indeed, the groove being left to cap a pedestal about thirty feet high, and conspicuous from every side. About one half the surface will be cleared of *débris*, so as to show fifty feet of the length of the groove, while the other half will remain as it is, beneath its protective covering of pebbles, gravel, sand, and mud, which acted as the graving tools in the firm grasp of the ice. In this condition it is to be presented to the Western Reserve Historical Society of Cleveland, to remain for the admiration and instruction of all future generations. I trust the citizens of the vicinity will appreciate the noble gift enough to occasionally visit the place and receive the deep impressions it is so well calculated to make.

G. FREDERICK WRIGHT.

Kelley's Island, O., June 9.

Pacific Air over the Rocky Mountains.

IN last August I called attention in *Science* to the enormous mass of Pacific air which for three months had been passing eastward over the mountains: also to the fact that there had been but little precipitation during the summer until near the middle of August, when, for the first time, solar halos appeared, and were followed by violent electrical storms. From September to the middle of last January the atmospheric circulation was in general feeble, consisting largely of gentle winds from the north-west. Late in January the south-west currents began to flow again, at first feebly, but becoming more and more persistent and aggressive. A remarkable series of storms has followed, one storm following another at intervals of four days to three weeks. At first, after a rush of north wind had ended a storm, it would be one or two weeks before the south-west winds were re-established. But as time went on it took less and less time, until in April two of the worst of northers cleared off with the upper south-west wind still in possession of the field, rushing over the higher mountains as if nothing had happened, and in a few hours it became the surface wind on the plains. At present the plains near the mountains are wetter than for years.

I have had opportunity to observe these storms at a point 20 miles east of the mountains, 27 miles north-east of Colorado Springs, at 6,800 feet elevation, and near the top of the high ridge which extends east from the mountains known as the Divide between Arkansas and Platte waters. Seen from that place the most common development of the general storms was as follows. First, high cirrus streamers and films are seen coming from the quadrant south to west, more often from about south-west. For a day or more the surface winds continue variable, but finally the south-west wind descends to the surface. Then for several days the south-west wind continues, sometimes with a high velocity.

The temperature rises, and the region no doubt by degrees becomes warmer than the adjacent regions or the high air above it.

Presently the time comes when the high cirrus rapidly thickens, the cigar-shaped masses of cirro-stratus or cirro-cumulus appear at lower levels, and soon a tumultuous mass of cumulo-stratus clouds develops far below. The latter frequently envelop the top of Pike's Peak, so they are from a mile to a mile and a half above the plains. These clouds soon coalesce into a continuous sheet, which develops fringes and festoons on its bottom and outer margin, and thus continues to descend. At this time there is usually but little surface wind. Sometimes the storm reaches this stage and then clears up again. When the cloud has nearly reached the plains there is a sudden rush of wind at the surface, bearing snow or rain. Usually the storm is inaugurated by a succession of squalls or hail-storms, — sometimes from the north. These squalls are often electrical. As squall follows squall the festooned outer border of the storm-cloud can be seen to enlarge laterally and sink to lower levels. The surface temperature rapidly falls, and the local storm-areas become connected by a great but not wholly homogeneous cloud of precipitation, which rushes either south or north over the Arkansas-Platte Divide. When the lower wind is at first from the south, it usually swings around to the east, then north-east, and finally north. This usually completes the storm, but not seldom the cycle is repeated. Often a rush of north wind for several hours is followed by a south wind, and then by a north wind again. During all this time there is more or less precipitation. Usually we are enveloped in the clouds of precipitation, but often there are small rifts in these clouds, through which the upper air movements can be observed. In this manner I have observed in almost every storm the higher clouds (mostly cirroid) coming rapidly from the south west for one or two days after the under-rush of cold saturated air began transverse to their direction. No matter whether the under-currents are going north, south, or west, the storms usually continue till the upper cirrus comes from the north; then the surface wind soon turns into the north, and the storm clears off cold. The lower cloud from which the precipitation occurs is seldom homogeneous in structure. In almost all cases it consists of a series of squalls, the local storm-areas being connected by stratus. This seems to be the general law of the Great Basin also. After general storms I have seen, both on the Wasatch and Rocky Mountains, great variations in the depth of snow on plains and mesas that could not be accounted for by differences of topography and altitude. In a recent rainstorm that covered a large part of Colorado east of the mountains these local storms were unusually well differentiated. The general storm began as a series of small thunder-storms, affording both hail and rain, each electrical area showing massive black cumulus clouds, which could easily be distinguished from the leaden and rather homogeneous stratus which extended from one of the local storm-areas to another. At one time three of these local storms could be seen in different directions. The development of the storm was signalized by a great fall in temperature. All the clouds afforded rain, but the fall was much more rapid from the electrical areas.

On June 9 a storm occurred as follows. The upper cirrus had been coming from the south-west for about three days, and hot winds from the same quarter had prevailed much of the time at the surface. During the night of June 8–9 there had been a heavy dew, a rare occurrence on the plains. Early June 9 a series of broad tracts of cirro-stratus formed along the eastern base of the mountains. Their western edges were situated a little east of the mountains. So near as the eye could estimate, these clouds occupied the same position all day. The separate flocks and fibres could be seen moving rather rapidly from the south-west. Evidently new cloud-fibres were being formed at the western edges of the cloud masses as fast as those already formed moved north-eastward.

During the afternoon there were numerous abortive attempts at storms on the mountains. Just before sunset an electrical storm began near the top of the Arkansas-Platte Divide. It was narrow, perhaps five or ten miles wide, from east to west, but it rapidly prolonged itself to a length of a hundred miles or more from north to south. The most important facts about this storm are these: the south to south-west winds which had prevailed at the surface during the day gave place to a violent cold wind from the north at the moment the storm-cloud was formed; moreover, this long, narrow storm was generated, as nearly as the eye could estimate, along the exact north-and-south line where during the earlier part of the day the formation of cloud had been going on along the western edges of the cirro-stratus tracts. The north wind raged at a high velocity for several hours.

This was peculiarly a plains storm. To the west there appeared but few clouds, and no storm of consequence was visible for at least two hundred miles along the mountains. Even Pike's Peak, who insists on dipping his head into every storm that comes into this region, had for once to be content with a few scattering clouds about his shoulders, and looked on in utter helplessness.

Summary. — (1) Over the mountain region there has been since January a very great and persistent movement of air from the south-west. (2) Unlike last summer, only a few days have at any time elapsed before halos and sun-dogs have appeared near the sun. They have invariably been followed by a rush of cold at the surface, causing abundant precipitation. (3) During the general storms of the winter and spring, the movement from the south-west continues one to three days after the lower clouds of precipitation have been formed in currents which travel hundreds of miles back and forth in directions transverse or even opposite to the upper movement. (4) The movement of clouds in the high atmosphere from the south-west is in most cases interrupted toward the end of a storm by high currents from the north or north-west; but in a few cases the movement from the south-west was either not interrupted or almost immediately resumed. (5) The formation of the clouds of precipitation during the general storms of winter and early spring proceeds from above downwards, and is usually aided by the development of local storms. There is a sudden and often great fall of temperature at the time the surface clouds of precipitation are formed, and this, too, whether the surface clouds go north or south. The general situation, then, is this: before the breaking of the storm the lower mile or two of the atmosphere consists of air from the south-west of a relatively warm temperature, and generally containing considerable moisture. The temperature is above the saturation point. When the storm breaks upon us the temperature suddenly falls below the point of precipitation and there is a great rush of cold air horizontally.

Several facts deserve special notice in this connection. First, the precipitation continues from five to forty or more miles after the surface under-current which contains the cloud of precipitation has passed the top of the Divide, hence while the air is being warmed by condensation while descending from five hundred to two thousand feet. Here is greater cooling than could take place from rarefaction alone while the air was being forced to higher elevations. Second, the cold under-current affords abundant precipitation, often for twenty-four to forty-eight hours, long enough for three hundred to twelve hundred miles of wind to pass. It is therefore a moist wind.

Now, no cold wind from either north or south could become colder in sinking from higher to lower levels, nor could it in descending to the earth become super-saturated with moisture, whereas it contained no clouds of precipitation at higher levels. We have therefore to look for the precipitated moisture in the lower atmosphere, which in this case is relatively warm up to the breaking of the storm. The most probable interpretation of the facts would seem to be this: the cool under-currents which bring the rain or snow consist mainly of the surface air, much of which is fresh from the Pacific region. This surface air becomes mixed with considerable bodies of cold air, which descend from above both at the fringed clouds and especially at the local storms. This cold air would be dry, but would receive radiation from the surrounding masses of warmer air, and thus cool them, and would partly mix with them. This cooling goes on in spite of the latent heat set free at the condensation of the vapor.

It is not my present purpose to discuss the mechanism of these movements whereby vast bodies of air leave an ocean warmed by the Japan current and press eastward so persistently over a dry, cold, and elevated plateau, and high range of mountains. That

would involve the question of a great Pacific atmospheric whirl, comparable to the supposed general movement during winter about the area of low pressure in the northern Atlantic. It would also involve a comparison of our weather here when we are in the Atlantic whirl with that which comes when the Pacific circulation pushes eastward over the mountains. There are numerous other questions involved in these observations, but they are postponed.

G. H. STONE.

Colorado Springs, Col., June 15.

Consecutive Lightning Flashes.

ABOUT 5.45 P.M. yesterday, while travelling over the "Jersey flats" on the Delaware, Lackawanna, and Western Railroad, I saw toward the south-west no less than six strokes of lightning following the same path — a nearly vertical one — in quick succession. The number was obtained from the grouping or "phrasing," as it were, of the flashes, which impressed itself on my mind. First there was a single flash, then a group of three, and then a group of two. They followed one another so rapidly that their separate character could just be distinguished, and the duration of the six must have been less than a second. I was at first inclined to believe that the paths had been precisely the same, even to the slightest sinuosity, but I am now inclined to think that they varied slightly, and that this variation aided me in recognizing their separate character. I am not aware that so many consecutive strokes have ever been noticed before. It may be interesting to add that this morning's papers report great damage by lightning in Elizabeth, N.J., in the direction of the observed flashes.

ARTHUR E. BOSTWICK.

New York, June 17.

Mocking-Birds and their Young.

AN educated Southern lady made to me the following statement, which seems too extraordinary to be true. My informant honestly considers it a fact. Is it true, or is she deluded by some accident? I leave the matter for those learned in the lore of birds to decide.

My friend says that while living in Mississippi, she frequently took young mocking-birds from a nest near the house, and placed them in a cage hanging on the verandah. The parent birds came, not to feed the young, but to endeavor to liberate them, by plucking at the cage. Failing in this, my friend says that they invariably brought to their imprisoned young bitter-sweet berries, which poisoned them, the birdlings only living a very short time after receiving the berries. She further said that the captives would do well as long as the parent birds were kept from the cage, but if by any inadvertence the cage was left on the verandah while the family went into the house, on returning they would find the bitter-sweet berries in the cage, and the little fledglings in a dying state. My informant further declared that this had occurred again and again within her experience, and that her grandfather gave strict orders that no mocking-birds should be captured, as their death would certainly be effected by the old birds. This is a strange story of bird-ways, that birds should be capable of choosing for their progeny death rather than captivity! I wish some of the Southern readers of *Science* would observe in the mocking-bird direction, and give us positive and recent information from careful experiment.

JULIA MCNAIR WRIGHT.

Fulton, Mo., June 16.

Thunder-Storms.

IT has been noticed in connection with thunder-storms in this vicinity this season that in every instance there has been an outflow of air in every direction from the storm, extending even beyond the area of precipitation and cloudiness. For example, in the case of a storm appearing upon the south-western horizon and moving due east, and passing then three or four miles south of this village, the weather-vane pointed directly toward it continuously, veering slowly from south-west to south-east, showing that the wind came steadily from the storm. The same thing also occurred in the case of a storm which appeared upon the north-western horizon and moved eastward, passing three or four miles north of the village. In this case the vane pointed directly toward the storm throughout, the winds being quite brisk. In other instances in which the storms passed directly over the village the same thing was manifest, the vane shifting sharply from west to east as the storms passed. In previous years I have noticed the puff of wind in front of an advancing thunder-storm moving in the same direction as the storm itself and occurring just before the rain begins to fall, but my attention has never been called to such an outflow of air in every direction as has been apparent in connection with thunder-storms recently. Whatever may be its explanation, it certainly is entirely inconsistent with the idea of an indraught and uprush at the centre of the storms in which it occurs.

M. A. VEEDER.

Lyons, N.Y., June 22.

BOOK-REVIEWS.

The Modalist, or the Laws of Rational Conviction. By EDWARD JOHN HAMILTON. Boston, Ginn. 8°. $1.40.

THE author of this work claims to have perfected the science of logic. He says in his introductory chapter: "The treatise now offered to the public is the result of long-continued studies which have had for their object to place the doctrines of logic on satisfactory foundations; and it would be false humility were the author to conceal his assurance that these studies have been successful. He claims to have completed a work which Aristotle left unfinished." And again he says, speaking of himself: "He knows what he has been enabled to do; he is certain that he has found the truth on every important point" (pp. 1 and 3).

When we come to examine the improvements that Mr. Hamilton claims to have made in the science, we find that they consist mainly in the introduction of modal syllogisms, that is, syllogisms in which the conclusion is expressed in terms of possibility, probability, or contingency, as distinguished from the ordinary, or pure, syllogism, in which the conclusion is categorical. Such syllogisms were treated of by Aristotle, but modern logicians have rejected them as not properly belonging to the science, since possibility, probability, etc., belong, not to the form of thought, but to its matter. They are properties, not of our thought, but of the facts and events that we think about, and therefore have no proper place in a work on theoretical logic. Mr. Hamilton, however, gives such modal syllogisms the foremost place among the forms of reasoning, affirming that "the pure syllogism is the secondary mode of thought, and should be interpreted by the modal." Yet he immediately adds that the pure syllogism "is the best expression of our ordinary reasonings" (p. 262), an admission which is fatal to his whole theory.

Another of Mr. Hamilton's innovations consists in treating the principle of antecedent and consequent, which lies at the basis of the hypothetical syllogism, as the first principle of all reasoning, even in the ordinary syllogism. Such a turning of logic topsy-turvy as Mr. Hamilton proposes seems to us the reverse of an improvement, and we believe it will be so regarded by thinkers generally.

AMONG THE PUBLISHERS.

AN illustrated article by Edwin Checkley, which introduces some of his new theories of physical culture, forms one of the features of the July *Lippincott*.

— Among its contents the *Chautauquan* for July has the following: "A Symposium — Where Should a College be Located?" by Julius H. Seelye, Henry Wade Rogers, James B. Angell, Hjalmar Hjorth Boyesen, W. R. Harper, and Herbert B. Adams; "Modern Methods of Treating Inebriety," by H. R. Chamberlain; "Objections to College Training for Girls," by Emily F. Wheeler; and "Elizabeth Thompson, the Philanthropist," by Frances E. Willard.

— The publishers of the *Illustrated American* of this city announce a *Monthly Illustrated American*. The monthly has been planned for over a year, and is offered to the public as "the cheapest and best illustrated magazine in the world." It is com-

posed of the magazine element of the weekly. Although the pictures will be, in the main, those employed in the weekly several months ago, there will be new and attractive reading matter. If it were not for this use of the plates the monthly would be an impossibility, the cost of making it being so great. The expense of publishing a weekly magazine of the character of the *Illustrated American* is so heavy that its price must necessarily be higher than the long-established weeklies. This price is the means of deterring many thousands from purchasing it, and in order to give people of small means a magazine at a nominal price it has been decided to issue the monthly at one dollar a year. Those who do not know the *Illustrated American* should ask for it the next time they pass a news-stand.

— G. P. Putnam's Sons have in press "The Living World: Whence it Came, and Whither it is Drifting," a review of the speculations concerning the origin and significance of life, of the facts known in regard to its development, and suggestions as to the direction in which the development is now tending, by H. W. Conn, professor of biology in Wesleyan University.

— A. E. Seaton, who is connected with Earle's Shipbuilding Company of Hull, England, will contribute to *Scribner's* steamship series an article on "Speed in Ocean Steamers," to appear in the July number. Commenting on the probability of "five-day steamers" on the Atlantic the author says: "It is always a question of *cui bono*, and when it is taken into consideration that the voyage between Sandy Hook and Queenstown is now done in 140 hours, and to do the distance in five days would require a speed of nearly 23¼ knots, with an increase in power of sixty-two per cent, and in fuel consumption of thirty-eight per cent, the cry must be regarded as a very far one at present. At the same time it is not desirable to believe that there is now finality in the speed of steamships, although by analogy with railway trains that conclusion might be arrived at."

— Macmillan & Co. have nearly ready for publication "A History of Human Marriage," by Dr. Edward Westermarck, lecturer on sociology at the University of Finland, Helsingfors. In an introductory note the work is commended to the attention of students by Dr. A. R. Wallace, who expresses a high opinion of the learning and insight displayed by the author. Dr. Westermarck differs widely in many respects from the opinions hitherto held by most anthropologists as to the development of the various forms of marriage.

— S. E. Cassino, 196 Summer Street, Boston, announces that the next edition of the "International Scientists' Directory" will be issued in the first half of 1892, two years from the date of publication of the former one. It is hoped that the new edition will contain nearly double the number of addresses given formerly, and the editor will be greatly pleased to receive any names which should be included. The foreign portion will be much more complete than formerly.

Publications received at Editor's Office, June 17–23.

HAMILTON, E. J. The Modalist; or, The Laws of Rational Conviction. Boston, Ginn. 331 p. 8°. $1.40.

IRON Ore District of East Texas, Reports on the, (Texas Geol. Survey). Austin, State. 326 p. 4°.

NEW YORK Agricultural Experiment Station, Ninth Annual Report of, for 1890. Albany, State. 488 p. 8°.

PURIFICATION of Sewage and Water. Experimental Investigations on, by the State Board of Health of Massachusetts. Part II. Boston, State. 910 p. 8°.

WOODHEAD, G. S. Bacteria and their Products (Contemporary Science Series). New York, Scribner. 459 p. 12°. $1.25.